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THE GEOGRAPHICAL REVIEW

PUBLISHED BY

THE AMERICAN GEOGRAPHICAL SOCIETY
OF NEW YORK

AUGUST

1916

THE GEOGRAPHICAL REVIEW

Published monthly by the American Geographical Society
Broadway at 156th Street, New York, N. Y.

August, 1916

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Single numbers, fifty cents — Five dollars a year

Entered as second-class matter, January 22, 1916, at the Post Office at New York, N. Y., under the act of August 24, 1912

THE
GEOGRAPHICAL REVIEW

VOL. II AUGUST, 1916 NO. 2

THE BIOGEOGRAPHY OF THE NORTHERN GREAT PLAINS*

By STEPHEN S. VISHER, Ph.D.

The Northern Great Plains region (map, Fig. 1) displays a rather monotonous and uninviting aspect. The characteristic vegetation of millions of acres is short grass, low herbs, and stunted shrubs, nearly all of which appear dead during more than half the year. Animal life, too, is rarely conspicuous and in general seems almost wanting. The signs of human occupation are few and not uncommonly of a doleful sort, unattractive shacks, stunted crops, or poorly constructed barbed-wire fences.

The region is far more attractive to the geographer who appreciates that it contains many evident and important responses to geographic conditions.[1] The fairly high latitude, location to the leeward of a lofty mountain range, the irregular and meager precipitation, and the rather uneventful geologic history of the region combine to produce the more direct influences: the amount of moisture and heat content of the soil, subsoil, and air, the compactness of soil and subsoil, the exposure of the surface to sun and wind, and the drainage. These factors are few in number and fairly uniform over large areas. They have acted as the chief selective agents in barring most of the many species which, for topographic reasons, have found it easy to attempt to establish themselves on the steppe.

Because of the comparatively simple geographic conditions, the paucity of species, the simplicity of structure of the plants, the unusual opportunities for field work and the many striking "adaptations" in plants and animals, this region appears especially suitable for a study in biogeography.

* This study is based on several summers' field work in South Dakota, eastern Montana and Wyoming, North Dakota, and northern Nebraska. The western two-thirds of South Dakota is the area from which most of the data were obtained, but the related biogeographic conditions in neighboring states are also included.

Much of the field work was done under the auspices of the South Dakota Geological and Natural History Survey. The writer wishes also to acknowledge assistance from Professors R. D. Salisbury and Henry C. Cowles, of the University of Chicago, and Victor E. Shelford, of the University of Illinois.

[1] A suggestive general discussion of the environmental reactions, plant, animal, and human, in the Northern Great Plains region, which is, however, not free from errors in generalization, is to be found in Wallace Craig: North Dakota Life, Plant, Animal, and Human, *Bull. Amer. Geogr. Soc.*, Vol. 40, 1908, pp. 321–332 and 401–415. S. S. Visher: Notes on the Significance of the Biota and Biogeography, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 509–520, also treats of various environmental reactions in the Northern Great Plains.

General Geographic Conditions of the Steppe

The greater part of the Northern Great Plains is a semi-arid grassland, large areas of which are dominated by short grasses and bunch grasses, and smaller areas by low shrubs. In the following discussion, the term steppe is used for these three semi-arid plant formations, the sub-humid prairie not being included.

The climatic conditions of the Northern Great Plains are severe. The rainfall is irregular in its distribution. It sometimes falls in hard showers and occasionally is accompanied by hail. Slight showers may bring the only precipitation received during long periods. Droughts of shorter (a few weeks) or longer (two or three seasons) duration are not rare. Ordinarily, about four-fifths of the total precipitation (which averages about 15 inches per year) takes place in the five growing months (April to August). The rest of the year is conspicuously dry. The relative humidity of the atmosphere in the steppe is low and the rate of evaporation high. In much of the area, the possible rate of evaporation is from two to five times the average rainfall.

Fig. 1—Sketch-map of the part of the Northern Great Plains especially studied. Scale, 1:9,000,000.

The numerals enclosed in circles correspond to the figure numbers and indicate where the photographs were taken.

The extreme yearly range of temperature is almost 150° F., and the daily range frequently 50°. The seasons are irregular as to time of occurrence, and summer maxima of 100° and winter minima of —40° are not rare. Freezes which terminate most of the vegetative activity sometimes occur as early as mid-September and as late as May, and less severe frosts as early as the beginning of September and as late as early June.

The wind velocities are seldom high, but an 8 to 12 mile breeze is almost constant during the daytime. In the summer, such winds may be exceedingly hot and, if the air is very dry, may wither the vegetation. When driving dry snow the high winds of winter are peculiarly severe.

There is little protection from the heat of the sun for the plants or for

non-burrowing animals, except those which can be sheltered by low shrubs, which are rarely dense, the larger herbs, and the very low cliffs ("cut banks") which are found here and there along the valleys. Dark, cloudy days are infrequent. With respect to conditions of light the steppe approaches the desert.

The More Conspicuous Plants and Animals[2]

While the intimate relations of the plant and animal populations of the Northern Great Plains to the physical conditions of the region are the chief theme of this paper it is necessary to introduce the main topic by a few summary paragraphs which list the characteristic forms of life in each group.

PLANTS[3]

The predominant plants are the grasses;[4] chief among these are grama grass, buffalo grass, wheat grass, and wire grass.

Plants of the composite family occupy second place. In the summer they are more conspicuous in many places than the grasses. Nearly a third of the common species belong to this family. The most noteworthy are:[5] blazing-star, golden-rod, cone-flower, golden aster, white aster, resin or gum-weed, nigger-head, worm-wood, sage, prairie-sage, sunflower, yarrow, prairie-pink, fleabane, and two with no common names, *Sideranthus, Actinella.*

The legume family ranks third. It includes some of the more abundant plants of these plains, notably[6] the prairie-clover, lead-plant, Dakota vetch, buffalo-bean, loco, lupine, and wild alfalfas (*Psoralea*) (Fig. 2).

Abundant monocotyledons, other than the grasses, are the wild onion and prairie lilies.[7] Dicotyledons other than the composites and legumes are numerous. There are several crucifers (mustard family), including[8] shepherd's purse, wall-flower, and *Lesquerella, Sophia, Arabis.* Several sorts of

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[2] The author is under obligations to the U. S. Biological Survey for determining the varieties of numerous mammals and a few birds; to P. A. Rydberg and Aven Nelson for naming plants; to Alexander Ruthven for determining reptiles and amphibians; and to L. P. Morse, W. M. Mann, and others for naming insects.

[3] The more important treatments of the plant ecology of the Northern Great Plains are R. Pound and F. E. Clements: The Phytogeography of Nebraska (Lincoln, 1900); H. L. Shantz: The Short Grass Formation of Colorado, *U. S. Dept. Agric. Bull. 201* (Washington, 1914); R. J. Pool: A Study of the Vegetation of the Sandhills of Nebraska, *Geol. and Nat. Hist. Surv. of Minnesota Botanical Studies,* Vol. 4, Part 3, pp. 189-312 (Minneapolis, 1914); and S. S. Visher: The Biology of South-Central South Dakota, *South Dakota Geol. and Biol. Surv. Bull. No. 5,* pp. 61-130 (Vermillion, 1912), and The Biology of Harding County, Northwestern South Dakota, *South Dakota Geol. Surv. Bull. No. 6,* pp. 11-103 (Vermillion, 1914).

[4] *Bouteloua oligostachya; Buchloe dactyloides; Agropyron tenerum, A. dasystachyum, A. Smithi; Sporobolus brevifolius.*

[5] *Liatris punctata; Solidago missouriensis, S. mollis, S. rigida, S. serotina; Rutibida columnaris; Chrysopsis mollis, C. hirsutissima; Aster hebecladus, A. oblongifolius; Grindelia squarrosa; Brauneria angustifolia; Ambrosia trifida; Artemisia frigida, A. aromatica; Helianthus Maximilianus; Achillea millefolium; Lygodesmia juncea; Erigeron asper, E. pumilus, E. ramosus; Sideranthus spinulosus; Actinella simplex.*

[6] *Petalostemon purpureus, P. oligophyllus; Amorpha canescens; Lotus americana; Astragalus caespitosus, A. succulentus, A. canadensis; Aragallus Lambertii; Lupinus argenteus; Psoralea argophylla, P. cuspidata, P. digitata, P. tenuiflora.*

[7] *Allium reticulatum* and *A. rubrum; Leucocrinum montanum* and *Fritillaria atropurpurea.*

[8] *Capsella bursa-pastoris; Erysimum asperum, E. inconspicuum; Lesquerella lindelli, L. argentia; Sophia incisa, S. pinnata; Arabis hirsuta.*

evening primroses[9] are conspicuous because of showy flowers. Chenopods[10] are plentiful in the more clayey or more sandy areas. Three genera of scrophs or beard's tongues[11] help adorn the plains. The roses, wild flax, milkwort, false mallow, puccoon, plantain, *Oreocarya,* and *Cogswellia* also are represented abundantly.[12]

BIRDS[13]

Among birds the only permanent resident represented by many individuals is the desert horned lark.[14] Longspurs of some species are found in all seasons, the chestnut-collared and McCown's longspurs nesting here abundantly and the Lapland longspur wintering here. Two other members of the sparrow family, the lark bunting and the western vesper sparrow, are very numerous. The former is quite characteristic as is also the desert horned lark. Other prominent nesting birds are the Brewer's blackbird, burrowing owl, Sennett's nighthawk, upland plover, marsh and Swainson's hawks. Formerly the long-billed curlew and the prairie sharp-tailed grouse were common. Several birds nest in the groves or scattered trees along the streams (considered here as woodland), but often feed upon the steppe far from their nests. Examples are the ferruginous, rough-legged, and sparrow hawks. The cliff and barn swallows, nesting on cliffs or about buildings, also are seen often.

MAMMALS

No conspicuous species appears to be confined in its range to the steppe of the Northern Great Plains, though several varieties are. Of these the plains coyote, plains pocket-gopher, certain mice and voles may be mentioned.[15] Other mammals abundantly represented on the steppe are the[16]

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[9] *Anagra albicaulis, A. Nuttallii; Onagra striagosa; Gaura coccinea; Meridolix serralula.*

[10] *Chenopodium album, C. Fremontii, C. uncanum, C. Watsonii, C. pratinocola, C. dacoticum; Atriplex argentea, A. canescens, A. Nuttallii, A. Suchleyana; Suaeda erecta.*

[11] *Castelleja flava; Orthocarpus luteus; Pentstemon acuminatus, P. albidus, P. erianthera, P. grandiflorus.*

[12] *Rosa arkansana, R. Fendleri, R. Woodsi; Linum Lewisii, L. rigidum; Polygala alba; Malvastrum coccineum; Lithospermum angustifolium, L. linearifolium; Onosmodium occidentale; Plantago elongata, P. Purshii; Oreocarya glomerata, O. perennis; Cogswellia macrocarpa, C. montana.*

[13] For somewhat detailed discussions of the birds of the steppe of South Dakota, see the sections on birds in the reports by the writer mentioned in footnote 3, and articles by him in *The Auk* for 1909, 1911-13, and the *Wilson Bulletin* for 1912, 1913, 1915.

[14] In the interest of brevity and simplicity, technical names are used here only in case the common name does not indicate the plant or animal under discussion with a definiteness sufficient for the purpose of this article. Since the American Ornithologists' Union adopted distinctive names for the American birds at an early date and since these names are now familiar to all students of birds, the common names may be used here without misunderstanding. The scientific names of various widely distributed and well-known animals, such as the pronghorn antelope, bison, gray wolf, striped gopher, common toad, and rattlesnake are given only once or twice. As most common names of plants apply to more than one species, technical names usually are necessary for precision, and therefore are used more frequently. Reference to a plant by its incomplete name implies that the species is the one enumerated in the list of conspicuous species, where technical names will be found, or the one mentioned only a few lines above.

[15] *Canis latrans; Thomomys clusius; Geomys (bursarius) lutescens; Peromyscus maniculatus nebrascensis, P. leucopus ariidulus; Perognathus fasciatus.*

[16] *Cynomys ludovicianus; Taxidea t. taxus; Lepus c. campestris; L. californicus melantois; Mephitis (Chincha) hudsonica; Spilogale interrupta; Canis nubilus; Vulpes velox; Mustela longicauda; Citellus tridecemlineatus olivaceus, C. t. tridecemlineatus; Antilocapra americana; Bison bison.*

prairie-dog, badger, jackrabbit, large and small skunks, gray wolf, kit-fox or swift, long-tailed weasel, thirteen-striped spermophile, and formerly the antelope and bison (Fig. 4).

OTHER ANIMALS

The most common snake is the plains bull snake, with the plains blue racer next, and the western prairie rattlesnake third in most places and seasons. The horned lizard is numerous in many localities. The common toad is seen frequently. The Great Plains toad is characteristic but not abundant.[17]

Invertebrates, aside from the insects, are unimportant in this group of associations. It appears that only three of the numerous phyla are represented, the protozoa relatively sparsely, mollusca chiefly by but one species of land snail (*Succinea grosvenorii*), and the arthropoda by a few spiders[18] and centipeds, and by numerous insects of six of the eight orders: Orthoptera (grasshoppers and locusts), Diptera (gnats, mosquitoes, flies), Lepidoptera (butterflies and moths), Coleoptera (beetles) and Hymenoptera (bees, wasps, ants, and ichneumons), and Hemiptera (bugs). The locust and grasshoppers[19] are the most conspicuous insects and most injurious.

The Hymenoptera of several families (digger wasps, ants, woolly bees) are abundant. Blow flies, bot flies (*Gastrophilus equi*), and robber flies are plentiful. Lepidoptera are few upon the steppe.[20] The beetles are mostly ground beetles.[21] Bugs are very rare on the steppe.

"Adaptations" of the Life of the Steppe to Geographic Conditions

PLANTS

The plants display a variety of characteristics seemingly related to the environment, including:

The predominance of perennial grasses and herbs, the latter belonging chiefly to the higher orders. Although in favorable years annuals are conspicuous, herbaceous perennials are the characteristic vegetation. There are no large shrubs, and no trees. This characteristic is in contrast to woodland, desert, prairie, tundra, and most marshes.

The relatively firm turf which prevails in the more favorable portions of the steppe hinders the establishment of annuals, which are much more conspicuous therefore in the more arid and more sandy portions. Prairie fires occur frequently where there is a fairly close turf, for reasons already mentioned. Fires are powerful factors in preventing the spread of trees

[17] The technical names of these reptiles are: *Pituophis catenifer sayi; Bascanion constrictor flaviventris; Crotalus confluentus;* and *Phrynosoma douglassi hermandesi;* of the toads: *Bufo americanus* and *B. cognatus.*

[18] Mostly of the jumping (*Phidippus*) and running types.

[19] The genera more abundantly represented include *Melanoplus* (*M. brivittatus* and others); *Sparagemon* (*S. aequale* and others); *Dactylotum* (*D. pictum*); *Phlibostoma; Hippiscus; Dissosteira* (*D. Carolina*); *Brachystola* (*B. magna*); *Nachyrhackis; Xiphidium; Opeia; Oecanthus; Hadrotettix* (*H. trifasciatus*).

[20] Perhaps the following include the more abundantly represented genera: *Argynnis; Apatelia; Basilarchia; Chrysophanus; Coenonympha; Colias; Lycaena; Thecla.*

[21] *Eleodes obsoleta, E. opaca, E. tricostata; Silpha ramosa; Harpalus caliginosus* and others.

FIG. 2—A view on a cattle ranch near the southwestern corner of South Dakota. The coarse herb in the foreground is the "wild alfalfa," *Psoralea*.

FIG. 3—A general view of farming country in Gregory County, south-central South Dakota.

and shrubs. The larger shrubs are restricted chiefly to the more arid or more rugged portions where vegetation is discontinuous in its distribution and where combustible material is separated rather widely. During the six or eight months in which there is little vegetative activity because of the lack of sufficient heat or moisture, evaporation from all exposed living surfaces is continued by the drying winds which prevail on the steppe. Plants not presenting living surfaces from which extensive evaporation takes place when the water lost cannot soon be replaced, have an advantage over other species. If planted on the steppe, most of the shrubs and trees not especially resistant to loss of moisture through the bark, are killed during the months of inactivity rather than during the normal summer season.

Compactness of stalk or flowers, or both. Compactness of stalk is illustrated by almost all the plants. Few abundant upland species reach a height, in ordinary seasons, of much more than a foot, and exceedingly few reach three feet. The majority have most of their bulk within six inches of the soil (Figs. 2 and 4). The rose, sunflower, sage, and golden-rod, which have representatives in other ecological formations, are in most cases represented on the steppe by the dwarfed species of the genus. Two striking examples of small size are the plains rose, in many cases a simple bush less than five inches tall which bears but one flower, and the plains sunflower, which in most cases is less than seven inches high and in dry years, especially on clay, has many individuals which are less than four inches high. The conspicuous places held in the flora by the Compositae points to compactness of flowering parts. Even the grasses (grama, buffalo, wheat, and others) have the spikelets somewhat compactly arranged instead of loosely as in typically prairie and woodland species. Compactness of growth decreases exposure to the winds. In most ecological formations an insufficiency of sunlight results in a diffuse and extended growth. There is no such insufficiency during the growing season in the steppe.

Specialization of the root system. There are many plants which have developed a shallow, wide-spreading root-system. This appears to be a response to the many slight showers, the water of which does not soak in deeply. The buffalo and grama grasses have roots which penetrate a foot from the surface. In contrast to these there are such deep-rooted plants as *Psoralea*, a rather coarse herb, which has almost all of its finer roots at a depth greater than four feet, and in some cases penetrates hard subsoil more than six feet, and looser materials still farther. Certain genera, including the sages (*Artemisia*) and *Gutierrezia*, have both well-developed lateral roots and rather deep tap-roots. Most plants which are abundant on the more impervious soils have shallower root systems than those in the looser soils. Shrubs and coarse herbs have root systems which go down to greater depths than do those of lesser plants, probably because of their greater exposure to the winds. They need firmer anchorage and a more reliable water supply than is found near the surface. The plants showing storage

of water in enlargements of the roots are chiefly the blazing-star, the Indian-turnip (*Psoralea esculenta*), and the bush morning-glory (*Ipomoea leptophylla*). The cacti (*Opuntia, Mamillaria*) are the only plants which store considerable amounts of water above ground.

Prevalence of narrow or small leaves or thick cutin (epidermis). Most of the plants have either short or narrow leaves or both, and a few, like the prairie-pink, *Gutierrezia*, and the cacti, are almost leafless. Abundant species with resin include the cone-flower, gum-weed, and *Psoralea*.[22]

Many species have a thick epidermis, which in many cases is covered by numerous dry scales. The sages (*Artemisia, Eurotia lanata*), *Psoraleas*, and *Antennarias* have a grayish coloration due to such scales (Fig. 2).

These characteristics of leaves and cover clearly retard evaporation and thus appear to be responses to the moisture conditions of the steppe.

Pollination and seed dispersal accomplished, in a vast majority of the species, by the wind. The seeds of nearly 90 per cent of the abundant species on the steppe are distributed by the wind. The tumble-weed habit, in which the aërial part of the plant becomes detached from the root and is rolled across the plains by the wind, is developed almost solely by plants of the wind-swept plains. Several species with this habit, belonging to several families, are represented abundantly in the Northern Great Plains. The chenopod family is the chief one and is represented by the giant tumble-weed, the Russian thistle, and the bug-weed. Two legumes, the Indian-turnip and the wild alfalfa, two species of the *Amaranthaceae*, a composite, and two grasses also have this habit.[23]

Persistent surface winds, few places of lodgment such as (1) bodies of water, (2) very rugged areas, (3) thickets and other places unfavorable for steppe plants, and the scarcity of other agents of dispersal, all have contributed to the predominance of species dispersed by the wind.

Ability to mature quickly. The ability to mature quickly is possessed by most plants in this formation. The period between killing frosts in spring and fall is short, averaging about 120 days and having a minimum length of more than a month less. The growing season is shortened usually still further by dry weather in August and September. Few conspicuous plants require more than two months for the maturing of their seeds, and many need even less time. This is in contrast to the condition in most other formations.

Time of growth not closely confined as to season. The climate of the steppe is variable. In some years the vegetation is two weeks ahead of normal, and the next year it may be far behind. Delayed rains may cause a surprisingly late flowering. We have found the rose and even the pasque flower late in August, following July and August rains and a very dry spring and early summer.

[22] Especially the case in *P. digitata, P. lincarifolia* and *P. tenuifolia*.

[23] The chenopods are *Cyclonia artipicifolium, Salsola pestifer*, and *Coriospermum hyssopifolium*: the legumes, *Psoralea esculenta* and *P. floribunda*; the amaranths, *Amaranthus albus* and *A. graecisans*; the composite, *Townsendia sericea*; the grasses, *Panicum capillare* and *Schedonnardus paniculatus*.

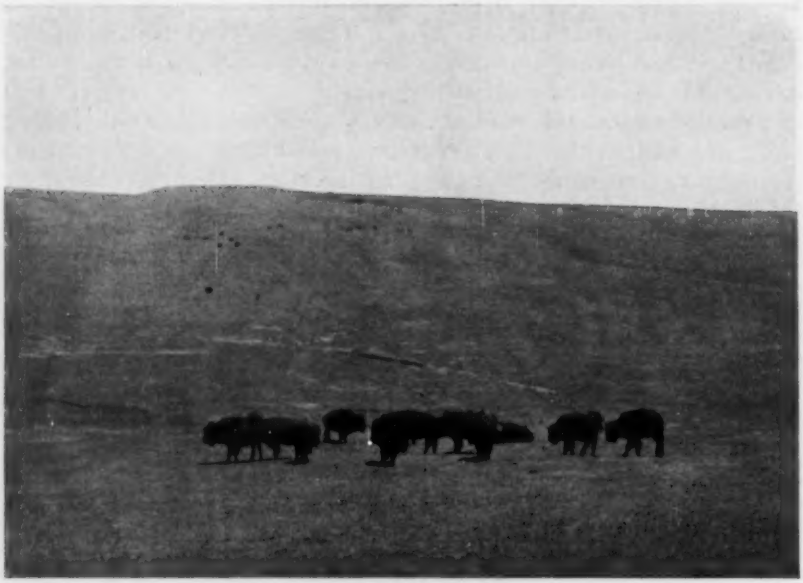

FIG. 4.

FIG. 5.

FIG. 4—A view in the buffalo-grama grass association near Pierre, S. D. The velvet-like smoothness of the vegetation is suggested. The bison, a protected and much-prized herd, recall the enormous herds formerly found in this region.

FIG. 5—The prickly-pear is one of the most conspicuous plants of many areas in the Northern Great Plains. The grass in flower is the grama grass, far more useful and gentle than the cactus. The warping noticeable in several sections of the cactus indicates a depletion of their water content. Shortly after rains they often are distended.

FIG. 6.

FIG. 7.

FIG. 6—The spurge "snow-on-the-mountain" is perhaps the most conspicuous annual of the southern half of the area under consideration.

FIG. 7—A view in the bunch-grass association of south-central South Dakota. The trees, on a cliff, are Rocky Mountain yellow pine. The near clumps of vegetation are bunch grass and yucca (Spanish bayonet), the latter in fruit.

Destruction of exposed parts usually does not result in the death of the plant. The characteristic steppe plants have a wonderful resistance to prairie-fires and grazing, which may frequently destroy the aërial parts. Many typical plants, such as trees and shrubs, of other ecological associations are killed by the destruction of only a small part of the aërial growth. Certain steppe species are killed, however, by too frequent fires (oftener than once in three years, for example) or by close pasturing.

Ability to withstand inactivity, forced by drought, for even two or three years. After a series of wet years there are many new immigrants into the steppe. A dry year or two decimates or eliminates species which are only visitants to the steppe. The characteristic species seem to be almost uninjured by even prolonged drought. In the summer of 1911, for example, there were localities which for two years had been so dry that almost no grass had grown; yet when the unusual rains of August came, the ground was green within a few days.

Resistance to unseasonable warm spells and frost. The vegetation does not start quickly in the spring; but if, after it has started, a freeze comes, surprisingly few of the more characteristic plants are killed. The native steppe vegetation is seldom affected noticeably by early autumn frosts. In areas less likely to have unseasonable frosts, many species are severely injured when such frosts occur.

Marked seasonal succession depending on accumulated heat, water content of the soil, relative humidity, and precipitation. The succession of flowers, in an ordinary year, is striking. There are at least five well-marked periods, the prevernal, vernal, aestival, serotinal, and autumnal. During one period the plains are dominated by one group of flowers and during the succeeding periods by still others. The early bloomers of the steppe include *Cymopterus acaulis,* pasque flower, violet (*Viola Nuttallii*), and prairie lily. Among those blooming in June are the beard's tongue,[24] onions, camas (*Zygodenus intermedius*), loco, buffalo bean (*Astragalus*),[25] wild flax.[26] In July, niggerhead (*Braunia*), prairie-clover, wild alfalfa (*Psoralea*),[27] false mallow, stemless evening primrose (*Gaura*), and spurge are prominent. During August, the numerous species of asters,[28] golden-rod,[29] and the fleabane (*Senicio canus*) are in their glory. The sages[30] are in full bloom early in September.

Accompanying this progressive activity there occur transformations in the floristic complexion of the region. *Early in the season the plants are related mainly to eastern or mountain species, while, as the season advances,*

[24] *Pentstemon acuminatus, P. albidus, P. eriantherа, P. grandiflorus.*

[25] *Astragalus caryocarpus, A. flexuosus, A. lotiflorus, A. microlobus, A. Missouriensis,* and *A. triphyllus,* in addition to those given in footnote 6.

[26] *Linum Lewisii, L. rigidum.*

[27] Mentioned in footnote 6. The next three plants are *Malvastrum coccineum; Gaura coccinea; Euphorbia marginata, E. arkansana.*

[28] *Aster commutatus, A. hebecladus, A. multiflorus, A. oblongifolius.*

[29] *Solidago memorialis,* in addition to those mentioned in footnote 5.

[30] *Artemisia aromatica, A. cana, A. frigida, A. ludoviciana.*

conditions become more severe and the active or dominant species are successively related to plants of the prairies, drier plains, and finally the desert.

This succession corresponds with changes in the temperature of air and soil and in the moisture-content of soil and atmosphere.

Predominance of yellow flowers. Many of the more abundant species are yellow, although several conspicuous flowers are white, orange, or pale blue. There are few reds, deep blues, or violets. Very few are streaked or mottled. In the vast majority of cases the flowers are small in size as compared with those of other plant formations, and few are particularly fragrant. The color probably is related to the light conditions, and the fragrance to the windiness, which also affects the size of flower.

BIRDS

The birds of the steppe possess two or more of the following characteristics:

Nests are necessarily built on the ground.

Many kinds sing while on the wing. Examples are the lark bunting, longspur, Sprague's pipit, and frequently the western meadow-lark and horned lark.

The songs and calls are louder than those of birds of woodland or prairie. Because of the climatic conditions of the steppe, representatives of species in many cases are farther apart than in most other areas. Calls and songs fulfill their chief purpose only when they are heard by other individuals of the species, and therefore need to be relatively loud in the steppe.

Social flocking[31] *is less prominent than among the birds of the woods, water, or prairies,* where not only do various species migrate in large flocks, but troops wander socially about in other seasons, especially in winter, and several abundant species nest in colonies. The grackle, crow, swift, swallows, night-herons, blackbirds, marsh wrens, numerous water-birds, and the bobolink and dickcissel are examples. If the cliff swallow, which nests here and there in the badlands, be excepted, none of the abundant birds of the steppe nest in colonies. The scattered distribution of life on the steppe, noted in the preceding paragraph, is exemplified in the distribution of the nests of the steppe birds. The lark bunting and longspurs, and occasionally the Swainson's hawk, migrate in flocks which soon break up, however. Flocking in the winter is largely accidental. Birds gather where food is available, in areas swept by the wind or in patches of taller vegetation which are not snow-covered. Weedy fields, where seeds are abundant, are the favorite sites of such gatherings.

Many have the ability to withstand strong wind. For example, seed-eaters feed during the winter in apparent comfort on wind-swept hills.

[31] Statements made by Wallace Craig in the paper referred to in footnote 1 have led to the erroneous generalization by a few animal ecologists unfamiliar with birds that gregariousness is a characteristic of steppe birds.

Females and nestlings are almost all protectively colored. This seems required by the exposure of the nesting sites.

Most species are highly migratory. Few individuals remain during winter, and these are of species different from those of summer, except in the case of the desert horned lark. Even this species migrates in a limited sense. The aridity and the inactivity of other life combine with the cold to encourage the desertion of the steppe during the winter season.

Most birds have the ability to withstand the intense heat of the sun. This is especially notable in the nestlings, which are often on dark ground.

The birds of the steppe of necessity must require but little drinking water. Heavy dews are rare.

The power of acute long-range vision appears to be possessed by a much larger number of the birds of the steppe than by those inhabiting woodlands. Clearness of atmosphere, moderate relief over large areas, and the widely scattered distribution of life all probably have encouraged the development of acute long-range vision.

MAMMALS

The mammals of the steppe have all acquired two or more of the following characteristics:

Ability to run swiftly. Examples are the antelope (32 miles an hour), jackrabbit (28 miles per hour), coyote (24 miles an hour), kit-fox, or swift (20 miles an hour), and gray wolf (20 miles an hour).[32]

It is possible to run more swiftly upon dry grassy plains than through woods or brush, in marshes or across rugged tracts. For this reason the inhabitants of such plains have come to be the fleetest of runners. Long-distance running was developed among some of the larger mammals, apparently because of the relative scarcity of places of retreat.

Ability to burrow. Examples are the pocket-gophers, striped gophers, badgers, prairie-dogs, mice voles. About 70 per cent of the species rear their young in burrows and nearly 50 per cent of the species spend much of their time underground. Burrows are retreats from heat, cold, wind, and some enemies, and for the prairie-dog, at least in some cases, furnish access to the underground water supply.

Many have acute long-range vision. The fleet runners all have. This appears to have been developed by the same factors mentioned in the discussion of the vision of birds.

A gray or tawny type of coloration which harmonizes well with dead leaves is possessed by nearly all. The skunk, an exception, is less in need of protective coloration than are the other mammals of the plains.

Ability to do without much drinking water. Water for physiological activity and for cooling by perspiration is secured mainly from the food

[32] Velocities are those attained by the normal, healthy adult when pursued by greyhounds, and are quoted from Ernest Thompson Seton: Life Histories of Northern Animals, 2 vols. (New York, 1909).

eaten. Footprints of most steppe mammals are seldom seen in mud about water holes. This is especially true in regard to the rodents, including the jackrabbit.

The daily period of activity is chiefly in the early morning, in the evening, and to a lesser degree at night. Voluntary activity of almost all abundant mammals of the steppe is very limited during the heat of the summer day, when as many as may are in the shade. Activity generates heat, which must be eliminated by perspiration, which in turn requires water, an article which is precious.

Ability to hibernate. The long-distance runners and the carnivores do not hibernate, but, with the exception of the rabbits, rodents, the most numerous mammals on the plains, do, and for longer periods than related species in other formations. Hibernation is a response to the unfavorable conditions which prevail during the winter months.

The larger herbivores, bison and antelope, migrated chiefly in response to irregularity in precipitation of rain and snow. Wolves, which preyed upon them, accompanied them in their wanderings.

A few of the mammals of the steppe are gregarious; the bison and antelope congregated probably for protection from wolves and bears and in response to the lack of numerous places of escape; but also in winter for the heat accumulated in a closely packed herd. Prairie-dogs are grouped into towns for protection against coyotes and certain hawks, and possibly by the somewhat restricted soil and ground-water conditions which they appear to require.

REPTILES

The reptiles, chief among which are the bull-snake, rattlesnake, and blue-racer, and the horned lizard, possess a surprisingly effective coloration; hibernate for nearly half the year, or even longer; can get along without drinking water; and are of small size as compared with related forms in more humid areas. Although the vast majority of reptiles lay eggs, two of the five abundant steppe reptiles (the rattler and horned lizard) bring forth their young alive. This may be in response to the "hard" climatic conditions which confront the young at birth.

INSECTS

Concerning the insects of the steppe, the following points may be made.

The diurnal period of greatest activity is in the forenoon from seven to eleven o'clock, after the chill of the early morning is gone, but before the heat becomes oppressive. Coitus is indulged in chiefly between eleven o'clock and one. During the rest of the twenty-four hours most of the insects are quiescent except when disturbed.

Seasonal activity is limited practically to the warmer and more moist three or four months of the year, chiefly June, July, and August. There is

almost complete inactivity during the colder and drier months of the year. Most species are dormant during ten or eleven months of the year, when many are represented chiefly by eggs.

Many forms burrow or occupy the burrows of mammals, in so doing having retreats from wind, heat, cold, and some enemies. Steppe species in many cases burrow to much greater depth than related species of other communities.

There is a predominance of hoppers or fast walkers. The development of hopping as a chief mode of progression is not so much discouraged on the steppe as in several other formations by frequent collisions with tall vegetation. The habit of running is favored by bare soil and is more marked among the insects of the drier than of the moister parts of the steppe, and still more among those of the desert.

Few species spend much time on the wing. The windiness of the steppe discourages extended flights. The occasional large flights of locusts form conspicuous exceptions to this rule.

Remarks Concerning the Several Associations Comprising the Steppe

The buffalo-grama grass, or climax steppe, association

This is the short-grass association par excellence and in many respects is the most characteristic steppe association (Fig. 4). In the central part of the steppe region it is found on a variety of medium soils, lighter clays, silts and loams, and is the dominant association over wide stretches. As the heavier and lighter soils are altered to loams by mixture and other processes, and as the drainage is perfected and ruggedness decreased, this association is extended at the expense of the other steppe associations.

To the east of the Great Plains province, the buffalo-grama grass association is represented on the high prairies on well-drained clay soil. In the more arid belt to the west it is found where the run-off is less rapid, as on the flattish tops of buttes and on terraces.

One of the two dominant grasses, the short, curly, buffalo grass is less tolerant of sand than is the taller grama grass, various species of which are of secondary importance in distinctly sandy areas.

The life of this association is more varied than that of other parts of the steppe. Many of the species mentioned as represented generally in the steppe are most abundant here, and in no other part of the steppe is found so large a number of species. In addition, the wire grass is abundant upon the more silty and loamy areas, and the needle grass (*Stipa*), and prairie June grass (*Koeloria cristata*) on the more sandy soil. The small milkweed (*Asclepias pumila*), the pincushion cactus (*Mamillaria vivipara*), and *Parosela aurea* are rather numerous.

Nearly all the birds of the steppe nest usually or occasionally in this association. Sprague's pipit is here characteristic. The bison and the prong-

horned antelope appear to have been at home here. The striped gopher is most abundant here, but reptiles and toads are less abundant.

THE NEEDLE GRASS, OR SANDY-LOAM STEPPE, ASSOCIATION

This association occupies uplands on sandy-loam soil and is characterized by the needle, devil's or spear grass, and June grass, just mentioned. In areas of rather uniform soil and topographic conditions these two grasses may dominate. In more sandy areas, coarse herbs of *Astragalus*,[33] lupines, and *Psoraleas* are very conspicuous and comparatively uniformly distributed, and sand grass occupies small areas, especially on slopes. In soils having a larger percentage of silt or clay, there are patches of buffalo and grama grass. The lead-plant is in evidence in areas of coarse sand or gravel mixed with finer materials. These herbs, and others that are represented less abundantly, have showy blue flowers. During the weeks preceding the shedding of the needles, this association is perhaps the most beautiful among all those of the steppe, because of the needles which glisten and wave in the breeze and the blue flowers then conspicuous. These are set off by the yellow and brownish flowers so widespread on the steppe. When the needles are ripe they become readily attached to clothing, long hair or wool, and by the help of several twists which develop as the needles dry, readily work inward and often cause pain. For obvious reasons, hay containing many needles is much less desirable than common prairie hay. The mowing and grazing, especially by sheep, of areas infested with needle grass is confined preferably to the season before the seeds begin to ripen early in July.

THE WHEAT GRASS, OR CLAY STEPPE, ASSOCIATION

The dominant grass on clay is the western wheat grass, sometimes popularly known as salt grass. It is widespread in areas where shales outcrop and along flood-plains. This grass has a very much larger percentage of its growth more than two inches from the soil than do the other widespread steppe grasses of fairly level areas. It also responds to an increased supply of water in a more satisfactory manner than the other abundant steppe grasses; in fact in some places and in some seasons, it attains a height of two feet. It therefore is a valuable hay crop along the flood-plains and on other areas which are flooded frequently, but upon which the water does not stand long. Because clay is relatively impervious, the percentage of absorption is slight except where the water stands for a time. In response to these geographic factors, enterprising farmers and stockmen erect wing dams and dig contour ditches in favorable places, and use flood waters to produce excellent meadows.

Although wheat grass is present in a rather pure stand in areas which are flooded frequently, in many places various other species are conspicuous.

[33] *Astragalus mollissimus, A. adsurgens, A. canadensis: Lupinus pusillus.*

The variety of abundant plant and animal life is normally less in this than in other parts of the steppe, however.

On well-drained slopes on the "gumbo," the vegetation is scanty except in wet seasons, and the soil is little concealed. Among the scattered growth of grass, various chenopods[34] and the crucifer pepper-grass (*Lepidium*) and prickly-pear cactus and the dock (*Rumex venosus*) are conspicuous in many places, as are also the Dakota veteh and the gumweed.

On the somewhat alkaline soil of many "blow-outs" and other undrained depressions, alkali grass replaces wheat grass, while the smaller prickly-pear (Fig. 5) is in many places exceedingly abundant. Two or three kinds of chenopods are often conspicuous.[35]

On valley flats the spurge, "snow-on-the-mountain" (*Euphorbia marginata, E. Arkansana*), is dominant in some seasons in many places, especially near the bluffs and in prairie-dog towns. It is perhaps the most conspicuous annual growing on the steppe (Fig. 6). The bur-tomato (*Solanum rostratum*) is another annual which is sometimes conspicuous in similar situations and also in deserted fields. Since valley flats receive the run-off from an extensive area, there is a sporadic occurrence of numerous species belonging to other associations, many of which, however, do not mature their seeds.

The wheat-grass association is at many points contiguous to groves along the streams and to shrubby associations, especially the buck bush and sage, and upon the areas of alluvium, with buffalo-grama or meadow-grass associations.

Few birds nest in the wheat-grass association. The relative barrenness of the upland areas and the frequency of flooding of the other portions are doubtless major deterrent influences. The sharp-tailed grouse, however, is more numerous in the flood-plain phase of this association than elsewhere, possibly because the taller vegetation affords more protection than the upland associations. Each prairie-dog town has one or more broods of burrowing owls.

The prairie-dog is the most conspicuous mammal. In parts of this association, notably in southwestern South Dakota, nearly every low terrace along the valleys is occupied along much of its extent by prairie-dog towns. The danger of being drowned out by the flood water is greatly decreased by piling up around each hole much of the dirt brought up from below. Many entrances are as much as 12 or 15 inches above the general level of the "flat." This piling up is not accidental, as is shown by the repeated repairing by scraping dirt in from the periphery of the mound, and by the fact that in areas not subject to frequent flooding the detritus brought up from

[34] *Atriplex canescens, A. hastata, A. Nuttallii, A. philonitra; Chenopodium album, C. Fremontii, C. glaucum, C. dacoticum, C. subglabrum, C. pratinicola, C. Watsonii; Corispermum nitidum; Monolepis nuttalliana; Suaeda erecta, S. depressa.*

[35] This grass is *Distichlis spicata;* the cactus *Opuntia fragilis;* the most numerous chenopods, *Atriplex canescens* and *Monolepis nuttalliana*. The purslane *Talinum parviflorum* sometimes is conspicuous and nearly always is characteristic of blow-outs.

below is scattered widely. The long-tailed weasel and the black-footed ferret, which prey upon the prairie-dog, are numerous, though not often seen. Gophers and other burrowing mammals are lacking in most of the flood-plain areas in the gumbo region, probably because of the floods.

THE BUNCH-GRASS, OR DRY-SOIL STEPPE, ASSOCIATION

The dominant feature of this association is the bunch grass, which attains a rather uniform height of about 15 inches. The clumps are stiff, sparingly eaten, and conspicuous throughout the year since they are seldom covered by snow for more than a short time.

This association has two distinct phases, (1) on slopes in rugged areas, bluffs along streams and in moraines, where the soil is not clay or sand; (2) on relatively pure sand. The latter may be subdivided into (a) the more nearly level stretches and (b) the sandhills. The first phase (Fig. 7) occupies but a small total area, but is widespread, being present in each of the districts and in most of the sub-districts of the Northern Great Plains. The second phase is best developed in middle and western Nebraska, where sand, commonly heaped into dunes, is dominant. The area of dunes reaches a very short distance into south-central South Dakota. This association also is present in some places along valleys where the alluvium is very sandy.

The determining geographic factors in this association appear to be a scarcity of moisture in the surface layers of the soil, and a soil which is readily penetrated by roots. In areas of sand, although the run-off is slight, there is normally but little moisture in the upper six inches or more. This is the result of the active evaporation which persists until the capillary tubes are broken. Consequently vegetation possessing only shallow root systems, as does much of that of the buffalo-grama and wheat-grass associations, is barred. The vegetation of this association is characterized by deeply penetrating root systems, in many cases with prominent "tap-roots."

The Spanish bayonet, or soap-weed (Fig. 7), is conspicuous, while *Mentzelia* and the pasque flower are numerous on the steeper slopes outside the sandhills.[36]

The bird most generally nesting in this association is the western vesper sparrow. The western field sparrow is locally numerous. Several mammals, notably the jackrabbit, coyote, and badger, often rear their young in the rugged areas dominated by bunch-grass. Such areas afford partial protection by their tall vegetation as well as by their relief. The rapid run-off is an additional factor in their desirability as bird resorts.

The sandhills[37] as seen from a distance are not inviting; they appear as a low line of monotonous yellowish hills, or, if one look down from a divide, a complex of irregularly arranged dunes with here and there the glimmer

[36] *Yucca glauca; Mentzelia nuda* and *M. decapetala; Pulsatilla hirsutissima.*

[37] R. J. Pool's study of the vegetation of the Nebraska sandhills (see footnote 3) is a voluminous report. For a brief earlier account, see S. S. Visher: The Plants of the South Dakota Sandhills, *American Botanist*, 1914.

of a pond. Only the bright yellow of a patch of freshly exposed sand, or the dark green of a marsh filled with vegetation, break the monotony.

It is only when one is within the dune district and sees the variety of vegetation that the reason for the reputation which sandhill districts have among botanists and picnickers becomes evident. There is a striking contrast between the more level, dry clay plains covered with a carpet of short "buffalo" grass and the rough sandhills, with their tall clumps of bunch grass, many fruiting shrubs, and narrow valleys filled with dense thickets through which ripple clear, cold brooks. Though the sand is fairly fertile, it is likely to drift badly when cultivated. Pastures here are in ill repute, because of the tendency of their soil to blow; and although there are small meadows, the roads are so heavy that it does not pay to haul hay far. Perhaps it is the impression of irredeemable wildness that gives the sandhills part of their attractiveness.

The many differences between the adjacent grassy plains and the sandhills seem to be due almost entirely to the sand. In elevation there is no notable difference; it is not likely that there is more precipitation; it is readily apparent that the sandhills in general are no cooler.

The sand, being loose and porous, absorbs at once all rainfall, even during a heavy shower. The result is that before any considerable percentage of a given rainfall has disappeared by evaporation it is beyond reach of the chief agents of evaporation. The balance escapes slowly from the many voluminous springs which supply the brooks and from the leaves of the vegetation.

As might be expected, the air temperatures become very high during sunny days, especially in the depressions. The vegetation must either be able to endure rapid evaporation or it must be able to resist drying by possessing restrictions against evaporation. Both responses are found. The bunch grass (*Andropogon*), roses, bush morning-glory, sunflower, and sand thistle are examples of the former; the cacti, sand cherry, yucca, and prairie-pink are conspicuous examples of the latter. A number of the characteristic plants have much longer tap roots than even closely related species of the areas of harder subsoil; a few, including the cacti, bush morning-glory, and *Psoralea lanceolata* have organs for storage of water.

The prominent plants are perhaps the following.[38] The bunch grass is dominant; sand grass, and spear or needle grass are common, both growing here in small clumps. Grasses growing between the bunch-grasses are hair grass, grama grass, and the sand-bur. The shrubs of the sandhills are sand-cherry, choke-cherry, plum, dogwood, prairie willow, lead plant, buffaloberry, and the wild rose. Spanish bayonet is abundant.

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[38] The technical names of these prominent plants are: *Andropogon scoparius, Calamovilfa longifolia, Stipa comata, Eragrostis trichoides, Bouteloua hirsuta, Cenchrus tribuloides; Prunus Besseyi, P. melancarpa, P. americana; Cornus stolonifera, Salix humilus, Amorpha canescens, Lepargyraea argentea; Rosa woodsi, R. arkansana, R. suffulta; Yucca glauca.*

FIG. 8.

FIG. 9.

FIG. 8—Looking southeastward from Sheep Mountain, S. D.: one of many splendid views in the White River badlands. The steep slopes are nearly bare. At the right a gnarled cedar and some greasewood plants may be seen.

FIG. 9—This view shows a remnant of a former terrace now dissected into superb badlands and largely barren; also a low terrace covered mostly by wheat grass tall enough to mow. In the most thoroughly drained parts of the "flat," the short-grass association is replacing that of wheat grass.

The more conspicuous herbs other than grasses are perhaps[39] the annual *Eriogonum*, spiderwort, brome rape, *Allonia*, *Abronia*, the spurges, the showy *Gilia*, green milkweed, and three members of the *Caper* family. Legumes are numerous, lupine, prairie clovers, and the narrow-leaved *Psoralcas* being most numerous. The more common composites are the wormwood, the viscid aster, and *Franseria acanthicarpa*. The borders of the brooks, often quite gay with flowers, are not truly a part of the steppe.

Most of the animal life of sandy regions is associated with the springs and streams. The areas occupied by the typical sandhill vegetation have a sparse and not distinctive fauna so far as the larger animals are concerned. Of such typical portions the birds most abundant are the western vesper sparrow, lark bunting, and the western meadowlark. Sandy areas within the prairie region of Sanborn County, eastern South Dakota, form eastern outliers of the breeding range of the prairie sharp-tailed grouse. The mammals most frequently seen are the jackrabbit, the cottontail,[40] and the plains chipmunk. Because of the relative wildness of rough, sandy areas, they form retreats for wide-ranging mammals such as wolves and coyotes. Of the reptiles, the most abundant snake is the hog-nosed adder. The yellow-striped swift is plentiful in the more southern sandhills, and another lizard occurs, as does a land turtle. Several insects are abundant in sandy areas, including certain tiger beetles and the ant lion.

The sandhill areas of Nebraska and along the southern margin of South Dakota have an exceptionally varied flora and fauna. In addition to species of more general distribution, mentioned above, the following are abundant there:[41] Hall's bunch grass, on the ridges; the southern sand-bur, the bush morning-glory, poison ivy, and dogwood. There are a few trees, especially the hackberry, cottonwood, and elm in depressions, or on the more stationary north-facing slopes. Among the herbs, the prickly poppy, sand thistle, *Froelichia campestris*, and a fourth representative of the Caper family are very conspicuous in season.

THE LOW SHRUB GROUP OF ASSOCIATIONS

This group of associations is represented in small areas, mostly by narrow bands, in the steppe formation. The buck-bush is a transition stage between grassland and woodland, and the sage brush between grassland and desert. Most of the area ordinarily classed as badlands belongs to the buffalo-grama

[39] The herbs referred to are: *Eriogonum annuum; Tradescantia occidentalis; Orobanche ludoviciana; Allonia linearis, A. nyctaginia; Abronia micrantha; Euphorbia hexagonum, E. Geyeri; Croton texensis; Gilia cephaloidea; Acerates viridiflora lineuris; Cleome lutea, C. serrulata; Polanisia trachysperma; Lupinus pusillus; Kuhnistera purpurea, K. villosa, K. alba; Psoralea lanceolata, P. tenuifolia; Ambrosia media, A. psilostachys; Machaeranthera sessiliflora.*

[40] The technical names of other animals mentioned in this paragraph are: *Sylvilagus nuttallii grangeri; Eutamias gallidus; Canus nubilus, C. latrans, C. n. nebracensis; Heteromn mexicus; Sciuroporus undulatus consobrinus; Cnemidophorus gularis; Terrepene ornata; Cincendela scutelaria, C. cuvibata, C. vermista.*

[41] *Andropogon Hallii, Cenchrus carolinianus, Ipomoea leptophylla, Rhus Rydbergi, Cornus stolonifera riparia, Celtis occidentalis, Populus Sargentii, Ulmus americana, Argemone intermedia, Cardnus plattensis, Cristatella Jamesii.*

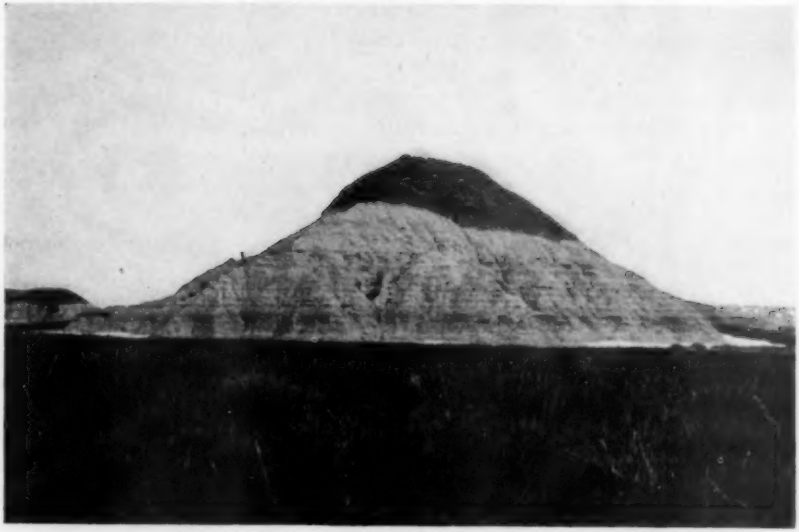

FIG. 10.

FIG. 11.

FIG. 10—A butte whose top is sand. The dense vegetation on the sand is in striking contrast with the nearly barren clay slope below.

FIG. 11—The "gumbo-lily," a stemless evening primrose, is one of the few herbs that grow upon the almost barren badland areas.

and the wheat-grass associations. However, on the steeper slopes, the portion most distinctly "badland," almost the only vegetation consists of various shrubs (Fig. 8).

Buck-bush. The buck-bush, or wolfberry (*Symphoricarpus occidentalis*), a shrub which as a rule is about 16 inches tall, forms patches in and adjacent to groves along valleys throughout the Northern Great Plains. It is also found here and there on slopes, especially where soil moisture is plentiful, which more often is the case on north-facing than on other slopes. Even far from woodland, there are patches along flood-plains where the ground water is within reach. The buck-bush patches, many of which have a diameter of several rods, have, where dense, little value for pasturage and almost none for fodder. They are cut by the mower with difficulty, nor are they killed readily by plow or fire. Wild roses are common secondary species in these patches. The chief grasses, in most places very subordinate in importance, are blue-joint (*Andropogon furcatus*) and wild rye (*Elymus canadensis*).

There are no large animals restricted to these patches, though there are many nests of birds. In the steppe region, the prairie sharp-tailed grouse, long-billed curlew, upland plover, marsh and Swainson hawks, and other large birds, as well as western meadowlarks and Brewer's blackbirds often nest here. Cottontail rabbits and gophers (*Citellus tridecemlineatus, C. Franklini*) are at home here. Spiders are especially abundant.

Sage-brush. The true sage-brush (*Artemisia tridentata*) is represented very locally in South Dakota or North Dakota on silt along the lower terraces of some of the streams of the western part of these states, notably along the Little Missouri River, Sage Creek in Pennington County, and Indian Creek in Fall River County, the two last in southwestern South Dakota. It is somewhat more widespread in northwestern Nebraska. In these states it is a low shrub attaining less than half the height prevalent in more arid regions to the west. However, the number of individuals per square rod in many places is greater than farther west.

The lance-leaved sage (*Artemisia longifolia, A. filifolia*) is more widespread and is here a taller shrub, reaching a height of two or even two and a half feet. In the western third of South Dakota it occupies silty soil chiefly on terraces.

The vegetation between the clumps of sage in many places is dominated by patches of buffalo grass. Upon soil which is almost bare, the curious foliatious lichen *Parmelia mollinscula* is abundant in many places. Clumps of prickly-pear cactus are conspicuous.

The most conspicuous bird characteristic of the sage-brush is the sage-hen, which was numerous here until a few years ago. It is being exterminated rapidly.

The most notable insect is the large black-and-white sage-moth, which is

FIG. 12.

FIG. 13.

FIG. 12—A view across the valley of the Teton, or Bad, River, showing part of Philip, S. D. Note the fine "bench," or "flat," just beyond the town.

FIG. 13—A "claim shanty" constructed chiefly of prairie sod.

very conspicuous for a few days in July and August. The larvae feed upon sage leaves.

Badlands. Badlands are developed in many places on clay in the Northern Great Plains; those in south-central South Dakota and in the Little Missouri Valley in North Dakota are especially extensive. Large sections of these badland areas are comparatively barren. Still larger portions are nearly level and grass covered (Fig. 9). The latter are discussed under the wheat-grass and buffalo-grama grass associations.

(*a*) *Conditions.* In regard to precipitation, these areas fare about the same as does the rest of the steppe. Their average temperature is probably greater because of the high percentage of slopes and partial protection from the wind. The whitish clay reflects the sunlight, resulting in a great intensity of light at times. During other hours of the day, a given spot may be in the shade. Shade can always be found along arroyos and behind steep-sided buttes. The rapidity of erosion in badlands, and the tendency of the clay to crumble and crack (Fig. 11), are two factors apparently very important in controlling vegetation. Another perhaps even more important factor is the inability of the materials to absorb or hold water. In the White River badlands there are some sandhills, and some of the badland buttes nearby are capped with sand. Erosion is evidently as rapid on such buttes as elsewhere, but a rank vegetation flourishes, apparently because of the water absorbed in the sand (Fig. 10).

(*b*) *Characteristic plants and animals.* In the more rugged badland areas, vegetation is scanty. Such as there is, is mainly shrubby and possesses long tap-roots. Various shrubby composites are especially conspicuous, especially the rabbit bush, *Gutierrezia Sarothrae, G. divaricata,* blue-aster, golden-aster, false bone-set, and several species of sage. Other plants are the gumbo-lily (Fig. 11), *Mentzelia,* salt bush, prickly pear, grease weed, and, locally, *Chenopodium Watsonii.* At the foot of the buttes, two annuals, the showy spurge, and thistle-tomato, frequently are found. Along the channels, the buffalo-berry forms many large thickets, and on the more shaded side of many buttes are clumps of western red cedar from which may be made good fence posts.[42]

The badlands, because of their relative inaccessibility, are the home of several carnivores. Gray wolves and coyotes are more frequently met here than in the plains roundabout. Bobcats[43] are plentiful. The puma, or mountain lion, was formerly not rare. A few antelope still feed on some of

[42] The scientific names of the above badland plants are: *Chrysothamnus graveleus; Senicio canus; Townsendia grandiflorum; Chrysopsis hirsutissima; Khunia glutinosa; Artemisia filifolia, A. longifolia, A. frigida; Pachylophus caespitosa, P. macroglottis, P. montanus; Mentzelia decapetala, M. nuda, M. stricta; Atriplex Nuttallii, A. Suckleyana, A. argentea; Opuntia fragilis; Sacracobatus vermiculatus; Euphorbia marginata; Solanum rostratum; Lepargraea (Shepherdia) argentea; Juniperus scopulorum, J. sabina.*

[43] The following are the technical names of the remaining mammals and reptiles mentioned: *Lynx rufus; Felis concolor; Antelocapra americana; Ovis canadensis audubomi; Odocoileus h. hemionus; Eutamias pallidus; Crotalus confluentus; Phrynosoma douglassii hernandesi.* A common bat is *Myotis californicus ciliobrum.*

the "flats." Bighorn sheep and mule deer formerly were common, and the bighorn may not yet be extinct in the White River badlands. The mammal now most frequently seen in badlands is the striped chipmunk. The chief birds are the rock wren, Say's phoebe, cliff swallow, violet green swallow, western lark sparrow, turkey buzzard, and prairie falcon. Rattlesnakes are not lacking, though far from common. The horned lizards ("toads") are seen occasionally.

(*c*) *The badland life* displays several peculiarities. The plants are mainly long-lived perennials, chiefly shrubby composites, and possess powerful tap and anchor roots and narrow and pubescent leaves. Such shrubs offer great resistance to erosion, undercutting, and slumping. They also are conservative, late-flowering, and present to cattle very little edible material. Nearly every species has yellow flowers. In addition to these perennials, there are various annuals which thrive during wet years on the moister alluvial flats.

The animals are grayish in color with the exception of the bats, swallows, and swifts. The crevices and cavelets furnish homes for the chipmunk, bat, bobcat, Say's phoebe, prairie falcon, and rock wren. The cliff swallow and white-throated swift find cliffs suitable for nesting sites. Several of the larger mammals, notably the bighorn sheep and mule or black-tailed deer, are powerful jumpers.

SALTA, AN EARLY COMMERCIAL CENTER OF ARGENTINA

By G. M. WRIGLEY

The Beginnings of Salta

Lima to Buenos Aires—a long road and weary for man and beast; an old road and romantic, worn by centuries of travel. Southward perhaps as far as Tucumán the road was an Inca institution. Garcilaso de la Vega says[1] Tucumán was subject to the Inca Vira-cocha and sent him tribute of cotton cloth, honey, maize, and other products of the country. But the old road is essentially Spanish, a tribute to the undaunted Spanish spirit that stayed not for physical barriers, and a monument of the restrictive colonial policy of Spain. The road runs from Atlantic to Pacific, not far short of 3,000 miles, and for half its length maintains an altitude above 12,000 feet. Along it, during the normal state of affairs, was carried all the colonial trade of the La Plata Provinces, going via Lima to Porto Bello on the isthmus of Panama, where the great annual fair focused the trade of an entire continent. The predominant feature of the commerce was the immense exportation of silver, practically the exclusive export of Peru. The demand for the precious metal was intense, and moreover it was a product whose nature and intrinsic value enabled it to stand the costs and difficulties of transportation. Equally it constituted a cargo whose transmission across the high seas was fraught with peril, whence was due, in no small measure, the adoption of the fleet and fair system, a method of trading antiquated in Europe.

The Lima-Buenos Aires road (Fig. 1) naturally called for the erection of settlements at strategic sites. On the Bolivian plateau it accounts for the early foundation of La Paz (1549), in the section between Potosí and Cuzco. In the Argentine section Salta is the most notable town owing its existence to the road. It lies roughly midway between the terminal points and thus in the early days was most remote from their respective authorities. Velasco, describing[2] the southern portion of the Viceroyalty of Peru in the second half of the sixteenth century, states that lack of communications prevented him from obtaining any knowledge of Tucumán and the territory under its jurisdiction (including Salta). Light is thrown on the frontier situation by the strenuous opposition[3] on the part of an early governor of Tucumán to the foundation of a town in Salta or Jujuy, lest improved communication

[1] Garcilaso de la Vega: Royal Commentaries of the Yncas, Book 5, Chapter 25, *Hakluyt Soc. Publs.*, 1st Ser., No. 45, London, 1871.

[2] (Juan) López de Velasco: Geografía y descripción universal de las Indias (written 1571-74), Madrid, 1894, p. 510.

[3] Pedro Lozano: Historia de la Conquista del Paraguay, Río Plata y Tucumán (written 1745), Buenos Aires, 1873-74, Vol. 4, p. 321.

should facilitate the conveyance to headquarters of information on his bad government!

The Bolivian plateau, as all parts of the realm where Inca rule had been firmly established, was remarkably safe for travel. The pampas, too, offered little trouble during the greater part of colonial times, but in the intermediate or transition section serious opposition was encountered from the natives. To the southeast of the Bolivian Andes, in the foothills, dwelt the Chiriguanas and on the Gran Chaco plains the Tobas and Matacos, savage and much-feared tribes. Even at the present day the Tobas have been but lightly touched by civilization. Immediately south, the Andean valleys, peopled by tribes more civilized but no less warlike, afforded the only practicable routes between plateau and plains—the *quebradas* of Humahuaca, del Toro, and Calchaquí. The Calchaquí were particularly troublesome. They were indeed only subdued by a rigorous campaign carried out in the middle of the seventeenth century. For ages inter-*quebradal* commerce had been carried on with the Valley of Lerma as center.[4] It was the meeting place for the *quebrada* routes and for those of the Chaco and Pampas. As a strategic location it was unrivaled.

FIG. 1—General location map showing the old mule trail from Buenos Aires to Lima (represented by the dotted line). Scale, 1:40,000,000.

In detail, the site of Salta offered exceptional advantages for defense. It lay between two rivers and in the midst of marshes and swamps, *tagaretes*, impenetrable save by a few easily guarded causeways. In 1582 Hernando de Lerma here founded the town to which he gave the name, subsequently changed to Salta, of San Felipe de Lerma. At various times efforts were made to change the site of the town, but the hygienic argument never proved strong enough, and Salta has maintained its old position and likewise its reputation for paludinal fever.[5] In the Archives of the

[4] Éric Boman: . . . Antiquités de la région andine, 4 vols., Paris, 1908: ref. in Vol. 1, p. 253.

[5] Paludism is still a serious problem in the provinces of Salta, Jujuy, and Catamarca. In Salta province the mortality from this disease is 143.3 per 1,000. During the last quarter of 1912 the hygienic commission waging a campaign against paludism treated 6,361 cases out of a total population of 138,043 (*Memoria del Ministerio del Interior, 1912-1913*, Buenos Aires, 1913, pp. 343-373).

FIG. 2.

FIG. 3.

FIG. 2—The Lerma Valley with the town of Salta in the middle distance, looking west.
FIG. 3—The agricultural lands of the Salta basin; looking east at a point near that from which Figure 2 was taken.
(The photographs in this article are from the collections of the Expedition to the Central Andes in 1913, under the auspices of the American Geographical Society.)

Indies[6] is preserved a document describing Salta eight months after its foundation: "It will be of importance in the event of war in the territory as in the valleys of Calchaquí, Omaguaca and Xuxui, lands very rich in gold and silver. This valley of Salta is very good and fertile, . . . highly suitable for raising cattle and foodstuffs in great variety; . . . . it should produce the vine in abundance . . . . It also borders on the Tobas, a bellicose people whose plundering habits grow worse day by day" (Figs. 2 and 3).

Colonial Salta and the Mule Trade

A point of mere strategic interest in 1582, Salta rapidly acquired fame as the center of a highly important phase of colonial internal trade.

The pampas of Buenos Aires bred stock in vast numbers: cattle, valued chiefly for their hides, horses, asses, and mules. The last-named beast of burden was destined in particular for service in Peru. The journey to this distant market was accomplished in three stages. The first, from the native pastures to Córdoba, was sufficiently arduous.[7] The treeless, stoneless pampas, with limited water supply, restricted the size of the troop to six or seven hundred head. Until the *monte*, or thornbush, region was entered near Córdoba, corrals had to be constructed of stakes bound by hide thongs, and incessant watchfulness was entailed on the part of the twelve muleteers, who with forty horses were attached to the average troop. Arrived at the objective the troop was pastured for some months. For such a purpose Córdoba was admirably adapted.[8] Situated in the basin of the Rio Primero, at the foot of the Cordovese Hills, it offered in the rainy season water and pasture in abundance.

Towards the end of April, the mules were newly formed into troops for the second stage. With the exception of the *travesia*,[9] a dry sandy zone

[6] Relación de las Provincias de Tucumán que dió Pedro Sotelo Narvaez, vecino de aquellas provincias, al muy ilustre Señor Licenciado Cepeda, Presidente deste Real Audiencia de La Plata. Relaciones Geográficas de Indias, Vol. 2, p. 150 (La Ciudad de Lerma), Madrid, 1885.

[7] The above description is largely based on material contained in the eighteenth century guide-book "El Lazarillo de Ciegos Caminantes desde Buenos-Ayres hasta Lima con sus Itinerarios segun la mas puntual observacion, con algunas noticias utiles á los Nuevos Comerciantes que tratan en Mulas; y otros Historicas. Sacado de las Memorias que hizo Don Alonso Carriò de la Vandera en este dilatado Viage, y Comision que tubo por la Corte para el arreglo de Correos, y Estafetas, Situacion, y ajusto de Postas, desde Montevideo. Por Don Calixto Bustamante Carlos Inca, alias Concolorcorvo Natural del Cuzco, que accompañò al referido Comisionado en dicho Viage, y escribiò sus Extractos." En Gijon, en la Imprenta de la Rovada, Año de 1773. The book is rare, and the exceptionally interesting nature of its contents is heightened by the mystery of its authorship and its publication. Though the place of publication is given as Gijon, authorities are generally agreed that the imprint was clandestinely executed in Lima. A limited edition with biographical notes and comments was published in Buenos Aires, 1908, by the Biblioteca de la Junta de Historia y Numismática Americana.

Brief notices on the Salta mule trade of colonial times may be found in contemporary works: Acarete du Biscay: An Account of a Voyage up the River de la Plata, London, 1698; Rolt: A New and Accurate History of South America, London, 1756; Antonio de Ulloa: Noticias Americanas, Madrid, 1792; and Antonio de Ulloa and Jorge Juan: Relacion Historica del Viaje a la America Meridional, Madrid, 1748.

[8] Córdoba has always been an important station on the road. Between the years 1602 and 1665 it was the seat of a custom house erected for the purpose of levying a 50 per cent impost on all commodities passing between Peru and the River Plate Provinces. C. E. Akers: A History of South America, London, 1904, p. 11.

[9] Woodbine Parish: Buenos Aires and the Provinces of the Rio de la Plata, London, 1838, p. 252.

FIG. 3—The agricultural lands of the Salta basin; looking east at a point near the Central Andes in 1913, under the auspices of the American Geographical Society. (The photographs in this article are from the collections of the Expedition to the Central Andes in 1913, under the auspices of the American Geographical Society.)

on the farther side of Santiago del Estero, the route was, at this season of the year, less difficult of accomplishment, and the troops could be augmented to thirteen or fourteen hundred head in charge of twenty men and seventy horses. The cavalcades aimed at reaching Salta not later than the end of June, i. e. at making the journey after the subsidence of the summer floods and before the period of maximum drought.[10] At Salta the mules remained in pasture until the fair, which began early in February and lasted throughout March. This was Salta's period of activity, though hardly, as Bustamante says, of pleasure. Damp meadows, well-nigh impassable roads[10] and the confinement of such numbers of beasts in a necessarily contracted space caused a discomfort not difficult to understand. At the fair were gathered men from the farthest parts of the Viceroyalty for the exchange of some 60,000 beasts, i. e. mules alone, without including the minor transactions in horses and cattle. Here, too, dealers from the pampas made the necessary arrangements for the return journey and Peruvian buyers for the transmission of their troops to the plateau. Salta merchants made no little profit out of the last item, for the muleteers engaged for the journey commonly took or were required to take a part of their wages in goods. The fair concluded towards the end of the rainy season when subsidence of the swollen mountain torrents permitted a safer continuation of the journey.

The troops, increased to seventeen or eighteen hundred head, set out from Salta under the care of two bands of horsemen.[11] The second band, required to check straying—facilitated alike by the topography and the freshness of the beasts—accompanied the cavalcade as far as the *quebrada* of Queta, 60 leagues beyond Salta. Beyond this point taming of the now chastened beasts was begun, and henceforth they could be turned loose to graze on the pastures of the mountain slopes, for pasture along the road was limited.

Thus by slow stages they reached the markets and distributing centers of the plateau. The chief of these were Oruro, Corporaca, and Jauja. Oruro was then as now a center for the mining districts of Bolivia (Upper Peru). Corporaca, a little south of Cuzco, served the central zone, and Jauja, within easy reach of the silver of Cerro de Pasco and the quicksilver of Huancavelica, was also on the royal road to Lima and the coast valleys.

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[10] The mean annual rainfall of Salta, for the period 1873 to 1907, is 571 mm. Of this amount only 16 mm. falls in the dry season, May to September (Walter G. Davis: Climate of the Argentine Republic. Argentine Meteorol. Office, Buenos Aires, 1910).

[11] Bustamante (*op. cit.* under 7) gives some interesting, but unfortunately incomplete, financial details. Young mules of the pampas valued at 1½ to 2 pesos sold in Córdoba at 4½ and in Salta at 8 to 8½ and exceptionally 9. Pasturing in Córdoba cost 5 to 6 reales (8 reales to 1 peso) per head with a refaction of 6 mules per 100; in Salta 1 peso per head. Wages paid were for the first stage 12 to 16 pesos, silver, with meat and Paraguay tea; for the second stage 70 pesos to the captain, 30 to his chief assistant, 20 each to the peons, with a steer every two days, Paraguay tea, tobacco and paper for cigarettes. For the third stage the wages varied according to the distance. For the captain it was 300 pesos up to Oruro, 500 to Cuzco or the Tablada de Corporaca, 850 to Jauja or the Tablada de Tucle; for the chief assistant the wages for these respective distances were 160 to 170, 225, and 360 pesos and for the peons 65, 120, and 175 pesos. Other expenses, the cost of horses, and losses would bring up the expenses of the trade.

Ulloa says[12] that 25,000 to 35,000 mules were pastured on the meadows of Canas, on the Tablada de Corporaca, and there sold in the great annual fair. Considerable numbers, too, found their way to the coast valleys, where, on the alfalfa pastures, they were so much better nurtured that they were good for four times as much work as in the mining districts of the plateau.

Colonial Salta, then, figures as the center of a commercial movement whereby tens of thousands of mules were annually transported from the plains to the plateau. Underlying the movement may be found the principle that dominated the whole colonial economy—exploitation of the precious metals.

Upper (post-revolutionary Bolivia) and Lower Peru constituted a vast territory over which population distribution was controlled most forcefully by mineral wealth. Practically all the Spanish towns, at least of Upper Peru, owed their existence directly or indirectly to mining. The mines were situated at great altitudes and often in remote and almost inaccessible spots. Today, even, nearly half of the Bolivian towns are at elevations exceeding 12,000 feet.[13] To support a population concentrated in places where cultivation was either limited or altogether impossible, agricultural settlements grew up in the valleys and basins. The classic example of this dependence —abnormal in the early development of a colony—is Potosí. Potosí stands on bleak mountain slopes at an altitude of 13,388 feet. During the days of its prosperity it was far and away the largest town of the western hemisphere; in the mid-seventeenth century it had a population of 160,000. The city drew its sustenance from a wide area, extending northwards to include Arequipa and its coast valleys and southwards to the Chilean valleys beyond the most arid section of the Atacama Desert (thus Chañaral, a "precious oasis of the desert," was, in 1678, granted with "all its waters" for the establishment of pastures for feeding the mules that carried cargoes of brandy to Potosí[14]), and eastwards to the Cuzco basin and *montaña* valleys. One of the chief contributors was La Paz, founded as a station on the road but prospering in virtue of its maize and bean fields and its advantageous location. Another was Cochabamba, typical of the fertile and climatically blessed basin towns of the eastern Andes.

The conveyance of the products from these various regions involved questions of transportation. A continual stream of laden beasts toiled into the great market place of Potosí. On smaller scales similar phenomena obtained elsewhere. Means of transportation were also required for the shipment of the minerals to the coast. Thus very early in colonial days were created problems of communication in a region where today, more than three centuries later, over-difficult transportation remains the supreme

[12] Antonio de Ulloa and Jorge Juan: Relacion Historica del Viaje a la America Meridional. Madrid. 1748.

[13] Isaiah Bowman: The Distribution of Population in Bolivia. *Bull. of the Geogr. Soc. of Philadelphia*, Vol. 7. 1909. pp. 74-93.

[14] C. M. Sayago: Historia de Copiapó, Copiapó, 1874. p. 83.

obstacle to progress. The navigable rivers were in the wrong places, and roads for wheeled traffic there were none. Transport was limited to the beast of burden, including man. The Indian, however, performed this service only to a limited extent and in the most inaccessible spots, even as he does today in certain mining districts.[15] The only other native beast of burden was the llama, a hardy and economical animal, but leisurely of movement and unable to carry heavy loads.[15] European beasts had been introduced by the Spaniards. Of these one was pre-eminently fitted for the onerous labor of transportation. The mule, acclimated even better than the llama to the variation of altitude and climate from plateau to coast, could carry larger cargoes at greater speed. Unfortunately the horse, one parent of the hybrid mule, is raised with difficulty at great altitudes. Only in the temperate basins of the plateau can horse-breeding be prosecuted successfully, and these areas, of which Cochabamba is illustrative, are limited.

Peru, then, was compelled to look afield for her supply of mules. Her demands were abundantly met on the unrivaled pastures of the La Plata Provinces. The chief features of the trade have been already indicated. In common with the general trade of the country it was characterized by periodic movement and maintenance in a system of fairs, principles of trading that still flourish in economically undeveloped South America. Between the regions of supply and demand intervened great spaces of difficult country that could not be crossed at a single stretch and along which adequate pasturage was only to be found at intervals. Seasonal variations of climate likewise restricted movement and encouraged periodic traffic, as in Russia the ice-bound condition of the rivers during the winter has concentrated commerce in the summer season and favored the development of trading by fairs. Under these controls the road from the pampas proceeded in as direct a line as possible to the comparatively well-watered Sierra de Córdoba and thence skirted the long line of Andean foothills through the settlements of Santiago del Estero and Tucumán to Salta, taking this second stage at a climatically suitable season.

Bustamante's old guide tells of an alternative route occasionally followed. It proceeded more directly north to economize on the pasturing season in Córdoba. Gathering mules from Santa Fé and Corrientes it passed through the eastern part of Santiago province fringing the southern Chaco country. But the mules had to be three and one-half to four years old before they could make the journey and needed a longer period of recuperation at Salta. A larger stock of provisions had to be carried, and the road was somewhat exposed to the attack of savage Indians; yet the greatest risk of

[15] An Indian carries 50 to 100 pounds, for short distances up to 300 pounds, and with a light cargo travels 18 to 25 miles a day. A llama carries 50 to 100 pounds and rarely travels more than 10 miles a day. A burro carries 100 to 150 pounds and travels 20 miles, a mule 200 to 300 pounds—normally the former—and travels 35 to 45 miles a day for journeys not exceeding 5 or 6 days—25 to 30 for longer distances. (W. L. Sisson: Informe sobre . . . de Ferrocarriles Bolivianos, La Paz, 1905, pp. 143-144.)

all was encountered from the hydrographic peculiarities of the region—either scarcity or superfluity of water. Along the main line of travel dangers of molestation were not great except in the transition zone, where a check was maintained by Salta and its dependent forts. A few leagues from Salta the fort of Cobos had been erected as an outpost against the Chaco Indians. Its garrison was supported by the excise fees on each head of mule leaving the town.

In addition to these circumstances conditioning trade in general, the peculiar features of traffic in live-stock rendered it particularly adaptable to the "fair" system. Fairs of live-stock are those which, retaining their ancient characteristics, have everywhere survived longest. Their business is done in produce that can be walked to market, distance being no insuperable obstacle. They deal in commodities that can most advantageously be purchased by direct and personal communication between buyer and seller.[16] Under such considerations Salta, lying in the transition zone (Fig. 4), was the natural site for the fair, for it was the natural meeting place between buyer and seller. Most important of all, the alluvial and well-watered flats of the main valley provided ample pasturage, the first requisite of the live-stock fair. However undesirable their properties from a hygienic point of view, the meadows of Salta were unquestionably excellent for the fattening of beasts. Pedro Lozano [17] speaks of their virtues with appreciation: "The admirable pastures so fatten the beasts [cattle] that from each one is taken at least six arrobas (150 pounds) and at times two quintals (224 pounds) of fat and tallow, from which with the ashes of a plant called 'vidriera' is made a rich soap that sells in Potosí at a considerable profit." Thus the pastures localized the trade and the fair.

The Wars of Independence and the Decline of the Salta Trade

In the latter half of the eighteenth century traffic along the Lima-Buenos Aires road began to decline. The output of silver from the Bolivian mines had decreased.[18] Buenos Aires, erected into a Viceroyalty in 1776 and with other South American colonies granted free trade for its port (1778), was relieved of economic dependence on Peru. The chief link binding the remote governments was broken. Reduction of traffic between them found a response in diminished security along the road; the Pampas Indians commenced the invasions and depredations that lasted uninterruptedly until their final subjugation was accomplished by General Roca in the campaign of 1879.

[16] See notes on "An Old-Established Fair in Modern France" and "Russian Fairs" in this number under "Geographical Record."

[17] Pedro Lozano: *op. cit.* under 3, Vol. 1, p. 276.

[18] During the first half of the seventeenth century the acknowledged annual production of silver from Potosí was, with one or two exceptions, over 5,000,000 pesos: during the corresponding period of the eighteenth century the average was under 2,000,000 pesos. (Razon certificada que se envio a Carlos III de las sumas que por los Reales derechos de Quintos y Diezmos . . . del famoso cerro de Potosí desde el año 1536 . . . hasta 31 de diciembre de 1783 . . . D. Lamberto de Sierra, *Colección de Documentos Inéditos para la Historia de España*, Vol. 5, Madrid, 1842-44.)

But the great blow to Salta's trade fell with the Wars of Independence. Then the province experienced in full the disadvantages attendant on its frontier location. It bore the brunt of the Royalist attack from the plateau and by the successful and gallant defense of its gauchos fully earned its title, "shield of Argentina." Close to Salta town itself is the field of Castañares, where in 1813 Belgrano vanquished the Royalist forces. The conclusion of the wars left Salta in an unhappy condition; not only had trade been suspended and markets extinguished or reduced but much havoc had been wrought amongst the live-stock, the produce upon which Salta was absolutely dependent. Andrews, who traveled through the country in the early twenties, describes Salta as relying on the surrounding provinces for articles of the commonest necessity[19] "possessing the finest timber, it is tributary to Tucumán for household furniture and even boards; with cotton indigenous, to Catamarca for candlewicks; to Santiago del Estero for dyes and wax; to San Juan and Rioja for wine and brandy; . . . for common earthenware utensils they are indebted to the Matacos Indians." The only attempt at cultivation seems to have been the sugar plantations, but these were few in number and operated so uneconomically that the product could not compete with the imported article.

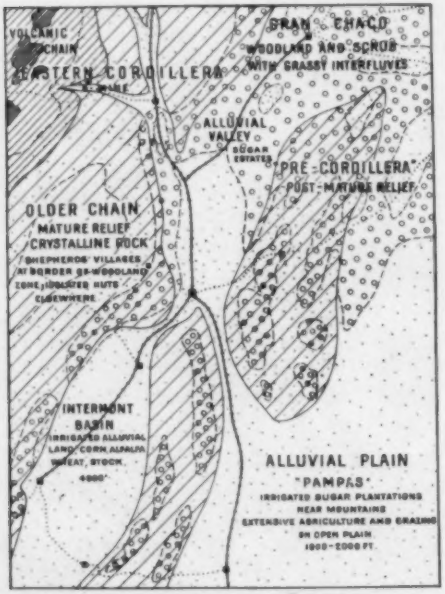

FIG. 4—Regional diagram of the eastern border of the Cordillera in the latitude of Salta.*

SALTA UNDER THE REPUBLIC

Though an integral part of the Argentine Republic, from the establishment of independence to recent days Salta has enjoyed far closer relationship with the republic over the northern border, Bolivia. Salta lies in the

[19] Captain Andrews . . . : Journey from Buenos Ayres . . . to Potosi . . . , to Arica . . . , to Santiago de Chili and Coquimbo undertaken on behalf of the Chilian and Peruvian Mining Association in the years 1825-26, London, 1827, p. 302.

* For an explanation of this type of diagram, with other examples, see note on pp. 424-425 in the June *Review*. The darkest shading represents steep snow-covered country; the next lower grade represents rough but snow-free country; the lightest shading represents moderate relief; and no shading represents plain or plateau. Small circles represent forest or woodland; dots represent pastoral or agricultural land.

transition zone between two great topographic and climatic regions. One of the factors contributing to the development of the town is the topographic break that necessitated a change in the methods of communication. Across the pampas oxcarts and coaches were used; at Salta change was made to mule-back for the plateau and its ascent. From the productive point of view, Salta, in common with the rest of the Argentine, was a pastoral region with agricultural potentialities (Fig. 4). The Bolivian plateau, with its mineral wealth, constituted an entirely different world. The difference has been well expressed by Huret.[20] Describing La Quiaca, on the upper edge of the plateau, he says "here it is no longer a question of cattle, nor corn, nor hectares, nor sugar, nor vegetables, as in Buenos Aires and Tucumán. Truly are we in another country. The only concern is the discovery of mines." Between two such complementary regions as Salta and Bolivia some degree of community was inevitable. And exchange was not limited to resources: it extended to the people. The frontier character of Salta is clearly evidenced in the prevalence of Quechua blood and language, sympathies and customs. The great native rebellion of 1780 that broke out north of the Titicaca basin gained the provinces of Salta and Jujuy. Today there is a considerable number of Bolivians in these frontier provinces. In Jujuy they constitute about eight per cent of the population according to the census of 1895.

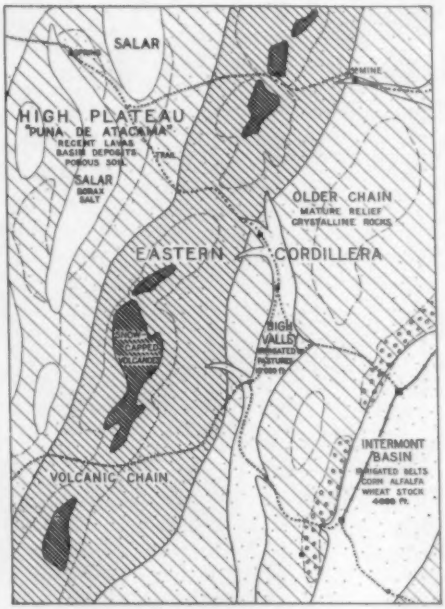

FIG. 5—Regional diagram of the Eastern Cordillera of northwestern Argentina showing typical high-valley environment.

Isolated from Buenos Aires and the La Plata Provinces,[21] Salta turned to the plateau (Fig. 5). Though the demand for mules was diminished, Bolivia and Peru continued to afford a not inconsiderable market for the old-time product, and changes began to develop in respect both of markets and products. The revolution that had finally opened South America to

[20] Jules Huret: En Argentine: De Buenos-Aires au Gran Chaco, Paris, 1912, p. 248.

[21] Temple says that in his journey of 1826 from Buenos Aires to Salta, a distance exceeding 1,200 miles, he met with travelers on four occasions only. Edmond Temple: Travels in Various Parts of Peru, including a Year's Residence at Potosí, London, 1830, p. 211.

world trade gave a tremendous impetus to Chilean mining, in particular of copper.[22] Prices of metal increased and costs of working diminished. Deposits hitherto unprofitable could be worked on a practical basis. Pros-

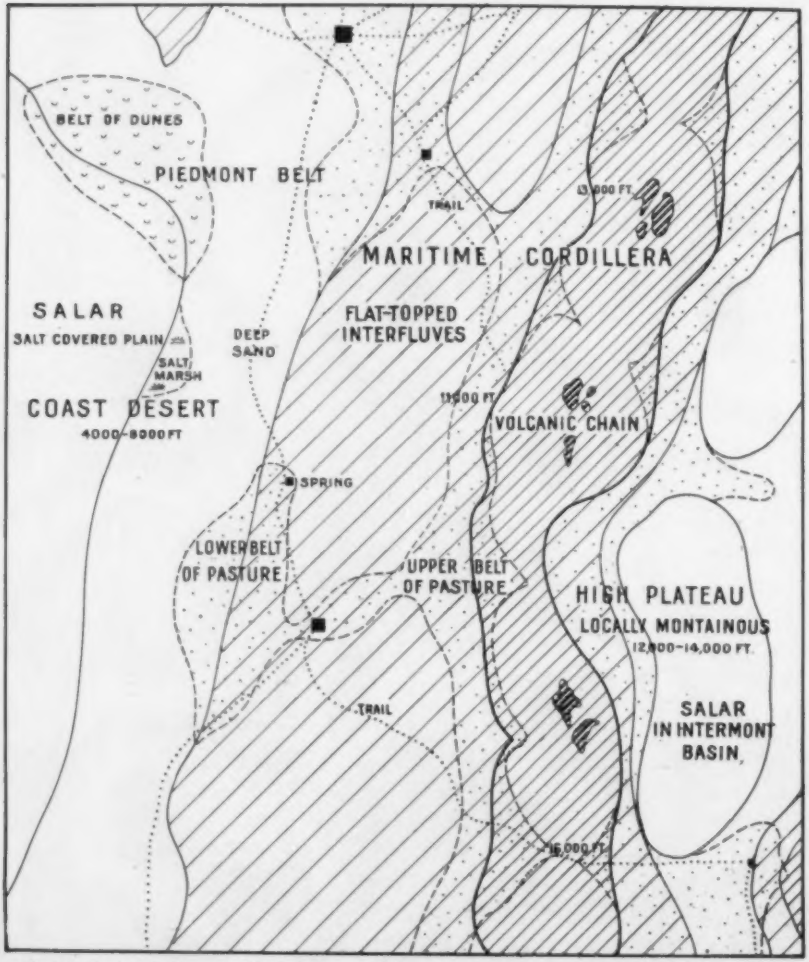

FIG. 6—Regional diagram of the western border of the Cordillera showing the elements of the physical environment at San Pedro de Atacama.

pecting and exploitation in new fields progressed apace. In the mid-century a further stimulus arose with the development of west coast shipping consequent on the discovery of gold in California. Expansion of ore mining in Atacama was followed by the beginnings of nitrate exploitation in the

[22] Basil Hall: Extracts from a Journal written on the Coasts of Chili, Peru and Mexico in the years 1820, 1821, 1822, Edinburgh, 1824.

more northerly provinces. To this activity Salta had a twofold relationship, industrial and commercial. The Salta peon went to work in the mines and nitrate fields: trade flourished across the Andes, and on the Argentine side Chilean currency began to circulate as freely as Bolivian and both more

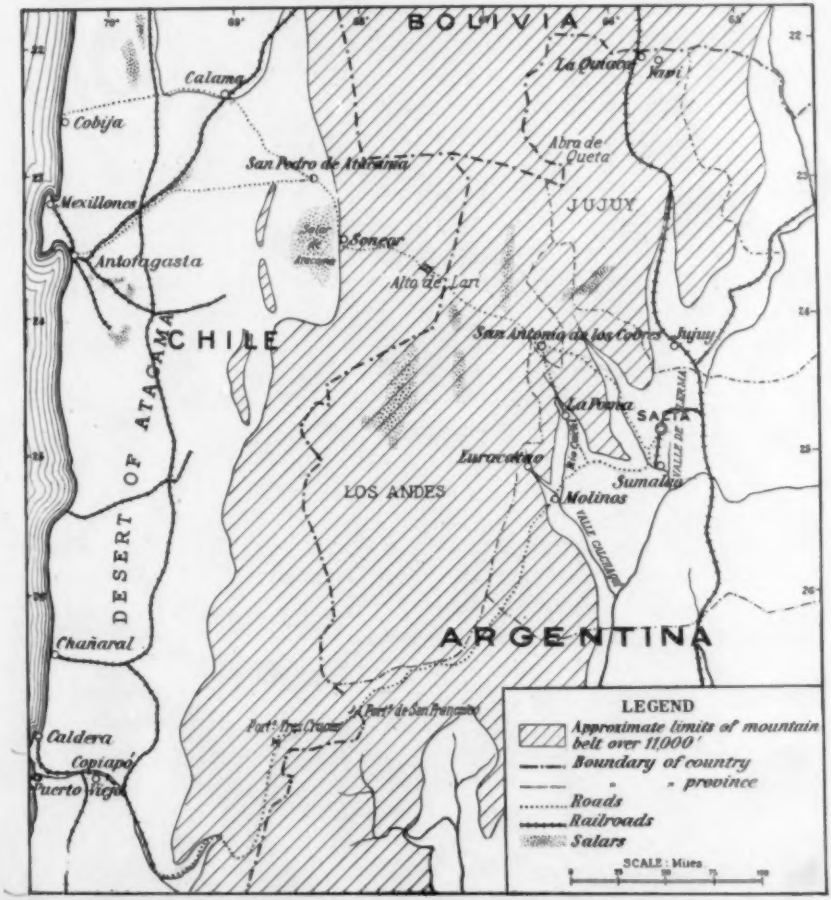

FIG. 7—General map of the Salta region showing, with Figure 1, all locations mentioned in the text.

generally than that of domestic denomination. On the Chilean side the channels of trade concentrated in the desert ports of Copiapó and Cobija.

While details of trade between these ports and Salta cannot be stated with any assurance, for statistical information relating to the period is necessarily deficient, the data cited by Moussy[23] from official sources is at least indicative of the general trend of trade.

[23] V. Martin de Moussy: Description de la Confédération Argentine, 3 vols., Paris, 1864; ref. in Vol. 3, p. 274.

TRADE OF SALTA FOR DECADE 1845-1854
(in *piastres fortes*)

	Export	*Import*	*Total*
With Bolivia	1,519,149	15,507	1,534,656
With the Pacific coast.....	188,158	1,736,169	1,924,327
With the Argentine littoral...	123,627	529,100	652,727

From Bolivia the chief articles of import were coca, chocolate, coffee, and straw hats—the produce of the warm valleys. The exports were mules, cattle on foot, goats, mares, asses, hides. The mules totaled 63,092, about a single year's export on the industry at its apogee. From the Pacific coast the import was European merchandise. Between Salta and the rest of the Argentine Republic the import was maté and goods of foreign manufacture, and the export was hides and chinchilla skins. The figures, however, make no allowance for contraband trade, which, especially in the two former routes, must have been carried on very extensively. Today coca, forming about half the export from Bolivia to Argentina and rated high in the scale of tariff, is smuggled across the frontier by devious routes through Lipez and the Puna de Atacama. According to official authority the figures quoted must be increased by thirty per cent. Nevertheless they clearly demonstrate the weak bond of trade between Salta and the Rio de la Plata. As late as 1886 similar conditions are manifested. For this year the value of animal products—hides, prepared leather, goat and kid skins, and wool—, transmitted from the northwest provinces to Buenos Aires via Córdoba, amounted to $9,396 in the case of Salta and $3,836 in the case of Jujuy, i. e. from the two together $13,232. Exportation from the same provinces to Bolivia totaled $157,503.[24] It comprehended 9,829 sheep, 8,558 burros, 2,945 mules, 1,000 horses, and 4,275 cattle. The figures for Salta and Jujuy are not given separately, but the former province was much the larger contributor. A significant feature of the list is the relative and increasing importance of the cattle export. This is one of the notable modifications of the Salta trade; another is the already noted development of new routes and markets.

The old route to Bolivia and Peru via Jujuy and the Humahuaca *quebrada* now encountered competition from the two new roads to the Pacific. These followed in part ancient trails by which the Indians of the puna and its high *quebradas* brought down their salt, goat skins, and woven fabrics to barter for the produce of the warmer valleys (Figs. 5 and 8). Thence they crossed the Atacama Desert to Copiapó and Cobija (succeeded later by Antofagasta) respectively.[25] The former or southern route passed through the Calchaquí Valley, creating in Molinos a commercial station of some importance, and thence, skirting the southern *salars* of the puna,

[24] F. Latzina: Geográfia de la República Argentina, Buenos Aires, 1888. p. 463.

[25] For details of roads crossing the Cordillera see Santiago Muñoz: Jeografía Descriptiva de las provincias de Atacama i Antofagasta, Santiago de Chile, 1904, p. 63 *et seq.*; Franz Kühn: Descripción del Camino desde Rosario de Lerma hasta Cachi, *Bol. Inst. Geogr. Argentino*, Vol. 24, 1910, pp. 42-50.

entered Chile by way of the passes of San Francisco and Tres Cruces. The more northerly route passed through the ancient copper mining site of San Antonio de los Cobres, the stretch of "Despoblado" to the oasis of San Pedro de Atacama, and thence across the Atacama Desert to Cobija. The routes were approximately the same length—500 miles, requiring about twenty days for accomplishment. Both were arduous. Between Salta and the Pacific seaboard intervene the cold desert of the puna (Fig. 6) and the warm desert of the coast. Throughout the routes water, fodder, and fuel are only encountered at intervals. The water is generally of poor quality, brackish, the fodder in certain localities unfortunately distinguished by the presence of grasses poisonous to all save *criollo* beasts; and the third necessity, fuel, limited to the resinous *yareta* and the various species collectively known as *tola*, has been largely denuded from the well-beaten tracks. But the greatest trial of all lies in the atmospheric conditions. In average altitude the puna ranges between 11,000 and 12,500 feet. Its heights rise to 20,000 feet and more, and some of its high western passes reach 16,500 feet, as for instance the terrible Alto de Lari on the Antofagasta road where "thousands of head of cattle have left their bones"[26] (Fig. 9). Over its bare and saline surface sweep frequent, in summer almost daily, storms. Those of winter are indeed less numerous but they are more demoralizing, and the night temperatures of the colder season are excessively low. Many an entire troop has succumbed to the dread "white wind" of the puna.[27] The reports of the first Spanish crossing of this region, Almagro's famous exploit, vividly detail the perils of the road.[28] Yet despite the hardships the routes were shorter and communication less interrupted and cheaper via the Pacific than the Atlantic. Page[29] of the United States Naval Expedition of 1859 investigated navigation on the Rio Salado (Santiago Province) and estimated that if practicable it would reduce the round trip from Salta to Rosario (distant 350 leagues by road) from eight or ten months to two and the expenses by half. At the time of his investigation freight charges along this route amounted to $2.00–$2.50 per *arroba* (25 pounds) while from Cobija they ranged from $1.50–$2.00.

Modern Salta

Towards the end of Argentina's great decade of railroad building, 1880-1890, the railroad arrived at Salta and Jujuy, and for these provinces the modern era may be said to have begun. The railroad traffic returns of the Ferrocarril Central Norte, the line connecting Salta and Jujuy with Tucumán, for so early a date as 1895 are significant. The values, given in

[26] Juan B. Ambrosetti: Viaje á la Puna de Atacama. *Bol. Inst. Geogr. Argentino*, Vol. 21, 1903, pp. 87-116.

[27] For a graphic description see Alejandro Bertrand: Memoria sobre las Cordilleras del Desierto de Atacama i Rejiones Limitrofes, Santiago de Chile, 1885.

[28] Historia de Copiapó, *op. cit.* under 14, or original sources: Garcilaso de la Vega: Historia General del Peru, 2nd edit., Madrid, 1722, Vol. 7, Chapter 13; Antonio de Herrera: Historia de las Indias Ocidentales (Decade V, p. 190), Antwerp, 1728.

[29] Thos. J. Page: La Plata, the Argentine Confederation, and Paraguay, New York, 1859, p. 414.

FIG. 8—Typical landscape of the higher *quebradas* west of Salta; in a tributary of the upper Calchaquí (Cachi) Valley above La Poma. The shepherd's grass-thatched stone hut and corral are at 12,100 feet. Similar habitations are found up to 15,000 feet, but seldom above, for although pasture runs up to 16,000 feet, there is easy access to the lower valleys. The cactus that forms so conspicuous a feature of the landscape has a vast range of utility; it furnishes the only construction wood of the inhabitants of the puna, who make long journeys for it to the eastern *quebradas*. It is also used for fodder and fuel.

tons, are: hides and skins, 1,139; flour, 2,584; sugar, 9,020; tobacco, 653; rice, 285; *aguardiente*, 803; wine, 797; lime, 3,983.[30]

The list is suggestive of a new economic outlook for Salta. The northern and western part of the province, occupied by puna and high valleys, must, it is true, remain ultimate grazing and mineral land, but the lower valleys, Calchaquí, Lerma, and the eastern plains extending over to the Chaco and with an elevation of only 300 feet, are adapted for cultivation of a wide range of temperate, sub-tropical, and tropical products (see Figs. 4 and 5). The Lerma Valley, 37 miles long and 15½ miles wide at an elevation of 3,937 feet, with alluvial soil and abundant opportunities for irrigation, has splendid possibilities. As yet Salta has not been in touch with outside markets long enough or fully enough to have more than begun the development of its agricultural and forestal resources. Only one-half of one per cent of the total area of the province is under cultivation. The staple product of Salta is still her staple of three centuries ago—live-stock, the typical frontier product. Increased acreage devoted to alfalfa has promoted the raising of cattle, at the expense of mule breeding and pasturing. For the cattle trade, as formerly for the all-important mule trade, the Lerma Valley remains the great gathering ground. Cattle brought from the Chaco are turned into the alfalfa meadows and cornfields to be fattened for the Cordilleran journey. Córdoba, that also retains some of its old-time business, sends many cattle to be sold on the Salta market. The locus of the great fair has been moved from the immediate confines of the town to Sumalao, a hamlet 24 miles or so to the south, where a big annual market is held in July.[31]

Besides the Lerma Valley and its tributary areas many small stock-raising establishments exist in the western *quebradas* of Salta and Jujuy and the recently created territory of Los Andes. They specialize in the fattening of stock for the Bolivian and Chilean markets. Brackebusch[32] has described the felicitous circumstances of Yavi on the Puna de Jujuy in consequence of its alfalfa pastures. In comparison with the neighboring hamlets of the puna it appears as "a veritable oasis." Here cattle and mules are pastured en route to the fairs of the Bolivian plateau. In this and similar locations an additional advantage is gained for the beasts by the period of rest. They are gradually acclimated to the change in altitudes and its attendant modifications.

In the territory of Los Andes the La Poma Valley offers a typical illustration of this phase of pastoral life.[33] La Poma is a hamlet of the upper Calchaquí (Cachi) Valley. Its elevation above sea-level is 10,000 feet. Five hundred hectares of the valley are under cultivation, some under wheat and barley but the major part under alfalfa, that at this high altitude

[30] Anuario de la Dirección General de Estadistica correspondiente al año 1895, Buenos Aires, 1896, Vol. 2 p. 341.

[31] Paul Walle: L'Argentine telle qu'elle est, Paris, [1912], p. 358.

[32] Ludwig Brackebusch: Viaje á la Provincia de Jujuy, Buenos Aires, 1883 (?), p. 48.

[33] Isaiah Bowman: Manuscript field notes of South American expedition of 1913.

flourishes amazingly well. Resowing need only be performed every twenty-five years, whereas in the lowlands of the Rio de la Plata it is a triennial operation. Live-stock is raised in the valley. Each small tenant farmer has a few beasts that he grazes on the steeper slopes above the alluvial patches. During the summer the valley is invaded by herds and troops from Catamarca and the adjacent provinces. An estimate places their number at 3,000 mules, 4,000 burros, and 3,000 cattle. They are pastured here and then pass on to the usual markets. A few of the natives make mule journeys into Bolivia for coca; some carry salt and borates from the *salars* of the Puna to the plains, but the pastoral business constitutes the main life of La Poma's six hundred inhabitants.

Luracatao, in a tributary valley of the Calchaquí, has a like reputation. It sends some three hundred head of cattle per month to Chile. They go in troops of sixty head, traveling about nine to twelve miles per day and going to markets even as far north as Iquique. The large-boned, large-hoofed beasts, shod for the journey, are of a type well fitted for such travel, but even they, especially during the winter, arrive in a very flaccid condition. It is estimated that they lose one hundred pounds on the road.[34]

The northern provinces of Argentina have to face the competition of the south in their Chilean trade. From Copiapó south the Chilean valleys are sufficiently well watered to engage in pastoral industry, in particular the fattening of stock for the mining and nitrate zones. It is reported that ten thousand head of cattle cross from Catamarca, Rioja, and San Juan to the alfalfa meadows of the Huasco valley alone.[35] Still farther south a new source of competition has been developed by the trans-Andine railroad. A comparison of the degree of the traffic along these several routes would be of considerable interest, but unfortunately reliable statistics are wanting.[36] During the first few years of the present century an obstacle was put in the way of cattle exportation from Argentina to Chile. Animals on foot formerly permitted to enter free of duty were subjected to increasingly high tariffs with the object of protecting the pastoral industry in the southern part of Chile. The greatest sufferers, however, were the mining centers and nitrate fields; for landing of the cattle from southern Chile frequently could not be effected for months at a time, and the impost was shortly removed.

The Future of Salta

With the completion in the near future of the Tupiza-La Quiaca railroad[37] the last link will be made in the iron road from Buenos Aires to Lima. Between the united republics is anticipated a great trade stimu-

[34] Eduardo A. Holmberg: Viaje por la Gobernación de Los Andes, Buenos Aires, 1900.

[35] L. J. Morales: Historia del Huasco, Valparaiso, 1897, p. 264; also Isaiah Bowman: Results of an Expedition to the Central Andes, *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 161-183.

[36] On the discrepancies between official figures of cattle imports from Argentina into Chile during the period 1901-1908 see Ricardo Pillado: Estudio sobre el comercio Argentino con las naciones limitrofes, Buenos Aires, 1910, p. 107.

[37] See note on the "Condition of the Pan-American Railroad between Buenos Aires and Lima" in the February *Review* (Vol. 1), p. 53.

lation in which the provinces of Jujuy and Salta should have a prominent share. Projects have also been discussed for connecting Salta with the Pacific by a trans-Andine line to Antofagasta and with the Paraguay River by a railroad through Formosa. The development of important cross roads in this extreme northwestern corner of Argentina seems inevitable, for it lies in a transition zone from east to west as well as from north to south. Somewhere in the region a great central mart must spring up. Salta, in virtue of its geographical "momentum," may become such and retain its present position of chief population center north of the zone of influence

FIG. 9—Near the pass at the western border of the Puna de Atacama above Soncor; see map, Fig. 7. Elevation 15,000 feet. The herd of cattle shown are from the Gran Chaco on the eastern border of the Andes. They were fattened at Salta and are now en route for the nitrate fields of northern Chile.

of Tucumán. Jujuy on the direct rail route threatens to be a powerful rival and is regarded by Salta with jealous eyes. The latter, however, has accomplished notable progress and improvements during the last few years and has grown vigorously. The population, rural and urban, given by the 1869 census as 16,877 and by the 1895 census as 20,361, is now estimated to be little short of 30,000.[38] The town of Salta has outgrown the appearance of a village and has become a modern city. It reckons among its people no longer merely the provincial, but also the cosmopolitan. Comfort and luxury have come in with the modern rise in land values. It is destined to become one of the greater cities of future Argentina.

[38] Results of the census of 1914 are to be published very shortly.

PIRATE COASTS OF THE MEDITERRANEAN SEA*

By ELLEN CHURCHILL SEMPLE

It is rather a significant parallel that the German and Austrian submarines, the commerce destroyers of the present war, frequent the same hunting-grounds in the Mediterranean as the ancient and mediaeval corsairs. They have been operating in the Iberian Sea, which forms the broad avenue leading to the Gibraltar gate; along the marine highway between Spain and the Balearic Isles, traveled by ships bound from Gibraltar to Marseilles; in and about the Sicilian Strait, where converge all lines of traffic between the eastern and the western basins; in the Strait of Otranto and the long Adriatic lane; in Cretan waters, which form the passways to the Aegean; and along the approaches to Alexandria and the Suez Isthmus.

The Mediterranean Sea has been the oldest and in some respects the greatest European training school of maritime activities. These it has coddled and guided and stimulated by a rare combination of geographic conditions. From time immemorial its coasts have sent out fishing fleets into all parts of the basin. From the days of the Cretan Minos it has produced a long succession of sea powers whose navies have sailed its waters far and wide and whose merchantmen have traded in its remotest ports.

A sinister form of maritime activity is found in the piracy which for ages was a recurrent phenomenon on many shores of the Mediterranean. It constituted a lawless combination of naval aggression and maritime commerce, seizure and sale without the formality of purchase. The blend of piracy and trade among early Phoenicians, Greeks, and Etruscans belonged to a primitive, undeveloped period when warfare was chronic, when stranger meant enemy, and when buccaneers executed a crude form of navigation act designed to crush competition in the markets of the home sea. Such undoubtedly was the attitude of the ancient Etruscan pirates toward Greek and Carthaginian ships which ventured to sail the Tyrrhenian Sea. They asserted the priority of their claim to those waters by attacking the coast and island settlements of the Greeks in the vicinity, with the purpose of discouraging encroachments upon their maritime preserves.[1] Piratical attacks were especially common in the Aegean when many of the Cyclades islands were occupied by Carians and perhaps by Phoenicians, and when national antagonisms emphasized commercial rivalry on the sea. Finally the Cretan Minos employed his naval power to conquer these islands, suppress piracy, and protect the revenues from his maritime empire, so that commerce by sea became more general.[2]

The decay of Cretan sea power after the Dorian invasion made possible

* A chapter from a forthcoming book on "Geographic Influences in the Ancient Mediterranean Basin."

[1] Mommsen: History of Rome, Vol. I, pp. 181-182 and 186. New York, 1905.

[2] Thucydides, I, 4-8.

the revival of piracy in Homeric times,[3] and converted the former police of the Aegean into wide-ranging corsairs. A passage in the Odyssey indicates that it was not an uncommon event for Cretan freebooters to carry off plunder from the Egyptian coast.[4] Homer represents the Phoenicians as kidnapping men and women to sell as slaves. Taphian pirates, Greek natives of a small island group off the west coast of Acarnania, stole a Sidonian woman and sold her to a Syrian prince. Both Taphians and Cretans, in Homeric times, were more corsairs than traders, and both were skilful mariners.[5] When seamen landed on a strange coast, they were asked, quite naturally: "Outlanders, whence come ye? Are ye robbers that rove the sea?" The general custom of slaying shipwrecked mariners,[6] on the assumption of their being pirates, points to the prevalence of the evil in the Mediterranean in legendary and early historical times.

The conspicuous fact in Mediterranean piracy is its repeated recrudescence whenever maritime political control is relaxed, and especially its constant recurrence, from the dawn of history down to the nineteenth century, in certain coast districts which are natural breeding places of sea-robbers. The stable factors tending constantly to produce this phenomenon are to be found in the geographic conditions obtaining in the Mediterranean. Owing to the configuration of the basin, traffic was compressed into certain narrow trade routes. These threaded their way between island and peninsula, entered sub-basins by the only possible gateway of the strait, and, when bent upon tapping the hinterland trade, concentrated on ports like Massilia and Alexandria, commanding the few breaches in the barrier boundaries of the Mediterranean. Thus traffic was restricted to fixed lines in a way impossible on the open ocean.

The sea hunter, therefore, knew various points where he was sure to bag his game. The pirate was the robber of the sea highways; and the highways of the Mediterranean were well defined and well traveled. The Oriental commerce in slaves and luxuries yielded such rich plunder to the freebooters, as it passed through Cretan waters between the Peloponnesus and Cyrenaica, that the pirates called this "the golden sea."[7] Just such geographically determined routes attracted the buccaneers of the American Mediterranean in the seventeenth century, as they swarmed out of their hiding places in the Antilles, to seize the gold and silver freight of the homebound Spanish caravels or the useful cargoes of the outbound ships. Here Jamaica, owing to its location, played the part of Crete as an advantageous piratical base; for it commanded several marine passages into the Caribbean Sea and was within striking distance of the Spanish treasure ships as they left the Isthmus of Panama and the Mexican ports.[8]

[3] Keller: Homeric Society, pp. 92-93. New York, 1902.
[4] Odyssey, XIV, 245 *et seq.*
[5] Odyssey, I, 181-185, XV, 426; XVI, 426; Strabo, Bk. X, Ch. II, 20; Herodotus, I, 2.
[6] Herodotus, IV, 103; Strabo, Bk XVII, Ch. I, 6, 19.; Vergil: Aeneid, III.
[7] Mommsen: History of Rome, Vol. IV, p. 309. New York, 1905.
[8] David Hanney: The Sea Trader, pp. 234 and 244. Boston, 1912.

The Mediterranean afforded a profitable field for the pirate, furthermore, because the wealth of the bordering lands lay within reach of his pillaging expeditions ashore. Owing to the prevailing rugged relief, the consequent paucity of land roads, the importance of "the wet ways" for communication and transportation, the scarcity of level land for cultivation, and the general discouragement of the barrier boundaries to inland expansion, population was concentrated on the coastal hems and small deltaic plains near the sea. Piratical raids upon these littoral communities forced the very early inhabitants of Greece, Thucydides tells us, to locate their cities from two to ten miles back from the shore.[9] Farther than this the pirates dared not penetrate, lest their escape should be cut off. The location on the inner edge of the coastal zone characterized not only the most ancient Greek cities, like Athens, Argos, Tiryns, Mycenae, Megara, and Corinth, but also the earliest Cretan towns and palaces of the Minoan period, such as Cnossus, Phaestus, Gortyna, Lyttus, and Praesus. These lay several miles back from the shore where each maintained a port or naval arsenal.[10]

The same cause and effect are manifest also in the western Mediterranean. The Etruscans, owing to their nautical efficiency, might have risked coastal settlements; yet as a matter of fact they placed their earliest towns several miles from the shore. Such was the location of Pisa, twenty stadia up the course of the Arno, which even in historical times was exposed to robber raids from Sardinia.[11] Such was that of Vetulonium, Volci, Caere, and Tarquinii on the Tyrrhenian littoral, as well as Spina and Atria, their Adriatic ports.[12] Strabo makes the generalization that the founders of the early Etruscan cities, as opposed to later ones, either avoided the coast or merely built fortifications there as defenses against pirates. The only exception which he found to this rule was Populonia (Piombino), located on the walled summit of a lofty promontory, with its little port on the inlet at the base.[13] But this possibly was no exception after all, for Populonia may have been originally one of the earliest Greek factories which temporarily occupied several capes and islands of the Etruscan coast, until their occupants were dispossessed by the native inhabitants.[14]

The necessity of occupying these salient points as coast defenses against the maritime Greeks, and their own growing sea power, drew the Etruscans coastward. They occupied also the promontories of Antium, Circei, and Surrentum on the coast of Latium and Campania and utilized them as pirate strongholds from which to conduct their depredations.[15] Fearing these attacks, the agricultural Latins located their most ancient villages at

[9] Thucydides, I, 7.
[10] Strabo, Bk. X, Ch. IV, 7, 11-14.
[11] Strabo, Bk. V, Ch. II, 5, 7.
[12] Mommsen: History of Rome, Vol. I, pp. 160-161, 179. New York, 1905. Pliny: Natural History, III, 20.
[13] Strabo, Bk. V, Ch. II, 6.
[14] Mommsen: History of Rome, Vol. I, pp. 177-178. New York, 1905.
[15] *Ibid.*, Vol. I, p. 181.

a respectful distance from the sea, even those like Lavinium, Laurentum, and the Rutulian Ardea, which belonged to the coastal zone.[16]

With the general development of maritime activity in the Mediterranean, the consequent decrease of piracy and increase of oversea colonization, sites on the outer edge of the littoral were selected for their ready access to commerce. Such of the older towns as were not too far from the seaboard established there each its own port. Thus there developed twin cities, port and capital, such as Rome and Ostia, Troezene and Pogon,[17] Athens and the Piraeus, Gortyna and Leben in Crete,[18] Cythera and Scandia in the island of Cythera,[19] and countless other primitive towns of inland location. Many of these felt the necessity of securing their connection with the sea against interruption in time of war and therefore built "long walls" like those which enclosed the thoroughfare between Athens and the Piraeus. Similar "long walls" connected Megara with its port of Nisaea[20] on the Saronic Gulf, Corinth with its port of Lechaeum on the Corinthian Gulf,[21] and were projected by Argos to ensure its communication with the sea at Nauplia in the Peloponnesian War, but when half finished were destroyed by the Spartans.[22]

The decline of Roman sea power in the last decades of the Republic led to a widespread recrudescence of piracy. The freebooters were emboldened to seize many coast towns and to carry their pillaging expeditions farther inland than ever before. Therefore the Gabinian Law, enacted in 67 B. C. for the suppression of piracy, conferred upon Pompey the dictatorship over the sea and over a coastal zone fifty miles wide, in order to include all the seaboard holdings and the inland refuges of the pirates.

The coastal population which was drawn shoreward when the seas were safe from marauders retreated anew to the interior on the revival of the buccaneer's trade. Thus the southern littoral of Italy, which was the site of flourishing seaboard settlements during the period of Greek colonial expansion, became wellnigh depopulated during the Middle Ages, owing to the century-long attacks of the Vandal, Saracen, and Algerine pirates,[23] who swooped down from the African coast, and the depredations of the Dalmatian corsairs, who issued from their haunts in the nearby Adriatic. Any one who has traveled along the seaboard railroad of southern Italy is familiar with the lonely little stations and the accompanying *marina*, or landing place, on the shore, while the unseen towns lie three to ten miles inland on acropolis sites in the mountains.[24] The same shifting of popula-

[16] Strabo, Bk. V, Ch. III, 2, 5.
[17] Strabo, Bk. VIII, Ch. VI, 14.
[18] Strabo, Bk. X, Ch. IV, 7, 11.
[19] Pausanias, Bk. III, Ch. XXIII, 1.
[20] Thucydides, I, 103.
[21] Strabo, Bk. VIII, Ch. VI, 22.
[22] Thucydides, V, 82-83.
[23] Norman Douglas: Old Calabria, pp. 135-140. Boston, 1915.
[24] Baedeker: Southern Italy, pp. 221-222, 225-228. Leipzig, 1903.

tion has occurred on other seas where pirates have flourished. The German city of Lübeck was originally located nearer the sea than at present; but after it had been frequently demolished by the pirates who scoured the Baltic coast in the Middle Ages, it was rebuilt farther inland up the Trave River. Gradually, with the return of security, it built up its port of Travemünde at the mouth of the estuary.[25]

Thus geographic conditions made the Mediterranean basin a good hunting ground for the pirate. But they did more than this. They condemned certain districts of its coasts to be natural breeding places for corsairs and sent their inhabitants out upon the sea to earn an infamous livelihood. The fundamental geographic condition on these coasts is the same that makes for systematic robbery also in mountains and deserts, during their protracted centuries of backward economic development. The land yields only a scanty food supply, which must be eked out therefore by raids upon neighboring territories. The predatory expeditions of the mountaineers are directed against the agricultural plains at the foot of the highlands, as those of the ancient Alpine tribes against the lowland settlements of northern Italy. The son of the desert turns his raid against the river-valley farm lands, like those of the Libyan tribesmen against the neighboring Nile delta.[26] Where the unproductive area abuts upon the sea, like the Dalmatian or Caucasus coast, its people prey upon the nearest thoroughfares of maritime commerce, like the brigand on the mountain pass road, or pillage the nearest productive seaboard.

It is to be noted, moreover, that where mountain or desert tribes or steppe nomads make their way out to such coasts, they bring with them the mind of robbers and only alter their raiding method. They adapt themselves to the seaboard environment, blend with the local inhabitants, from whom they learn the art of navigation, and pursue their ancestral trade, exchanging the desert camel and steppe pony for the swift-moving ship. The mental habit of the previous habitat harmonizes with the economic conditions of the new one. This was true of the Illyrian pirates, whose highland brethren for centuries raided the frontiers of ancient Macedonia; it was true of the desert-bred Saracens wherever they touched the Mediterranean coasts, though their inland settlements were models of careful tillage and thriving industries; it was true of the ancient nomad Scythians[27] and later of the nomad Tatars when they settled on the Black Sea shore, and of the Zaporagian Cossacks of the Russian steppes, who in the seventeenth century put out from the Dnieper estuary in their frail skiffs to ravage the Turkish coasts.[28]

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[25] R. Reinhard: Die wichtigsten deutschen Seehandelstädte, p. 23. Stuttgart, 1901.

[26] For the general principles, see Friedrich Ratzel: Anthropogeographie, Vol. I, pp. 154 and 435, Stuttgart, 1899, and E. C. Semple: Influences of Geographic Environment, pp. 234-235, 490-496, 553-554, 586-591. New York, 1911.

[27] Strabo, Bk. VII, Ch. IV, 2, 6.

[28] For vivid description, see Gogol's novel "Taras Bulba," translated by Isabel Hapgood.

Like a natural product of the soil, pirates were a constant or recurrent phenomenon on the whole southern coast of Asia Minor, comprising ancient Lycia, Pamphylia, and Cilicia;[29] on the rugged littoral of Clazomenae peninsula of Asia Minor, where Mount Corycus rises abruptly from the sea;[30] in many Aegean islands and especially Crete; on the forbidding Caucasus coast of the Euxine where all geographical conditions were hostile to civilization;[31] on the Illyrian or Dalmatian coast of the Adriatic; on the Atlas-walled front of the African shore, the so-called Barbary coast; and in the Balearic Archipelago and Corsica.

All these districts, whether on islands, peninsulas, or continental shores, have in common certain geographic conditions which combined to force or lure the inhabitants into a piratical mode of life. So soon as war interrupted their few regular industries, or a corrupt government failed to hold them under restraint, or the maritime powers which policed the Mediterranean became weak or disorganized, these regions flashed into piracy. They were all mountainous coasts, broken up into isolated coves and valleys in which a strong centralized government was next to impossible, and endowed with little alluvial land. Natural conditions reduced tillage to a minimum and prevented the concentration of population necessary for local industries as a basis for commerce. The islands suffered always from the handicap of limited land, and therefore were more addicted to piracy, Thucydides tells us, than the continents. Samos, only 182 square miles in area, laid the financial and naval foundations of its great power under Polycrates (532-522 B. C.) by a long career of piracy. Its penteconters cruised the Aegean, plundering Greek and barbarian alike, levying blackmail for safe conduct. After the tyrant had made his fleet supreme on the sea, he organized the coasts and islands into a maritime confederation of wide extent; but the restless Samians easily reverted to their freebooting activities when opportunity arose.[32] Crete, though it was a large island and had a fertile maritime plain of some extent at the northern base of its long mountain range, gave evidence of a constant food problem. Like mountainous Arcadia and Aetolia, in order to reduce the pressure of population upon the limits of subsistence, it became a standing source for mercenary troops in the ancient Mediterranean,[33] when a strong hand kept order on the sea. When the hand was removed, Crete became a chronic source of pirates. On these, as on other islands, human life has resorted to crime in order to equalize population and food supply.[34]

On the rugged continental coasts of the Mediterranean, the mountains

[29] Strabo, Bk. IV, Ch. V, 1, 2, 3, 6.

[30] Strabo, Bk. XIV, Ch. I, 35. Livius: Historia, XXXVII, 27.

[31] Strabo, Bk. XI, Ch. II, 12, 15.

[32] Herodotus, III, 39, 47, 57-59. Ernst Curtius: History of Greece, Vol. II, pp. 161-162, 170 and 212. New York, 1871.

[33] Thucydides, VI, 25, 43; VII, 67. Polybius, II, 66; III, 75; V, 13, 14, 65, 79; XIII, 6; XXXI, 26; XXXIII, 16.

[34] E. C. Semple: Influences of Geographic Environment, pp. 67 and 461-465. New York, 1911.

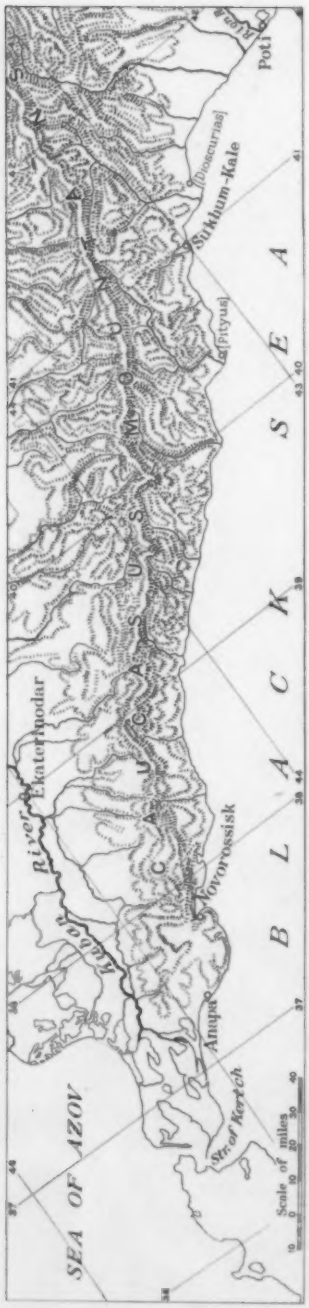

Fig. 1—The Caucasus coast of the Black Sea. Scale, 13,000,000. (Ancient names in half-line type.)

provided timber for ships, but seriously impeded communication with the hinterland. Moreover, that hinterland was undeveloped on account of the mountain barrier, as in the case of the Illyrian interior; or unproductive on account of an arid climate, as in the case of the Cilician, Caucasus, and Atlas back-country. Hence it furnished no incentive for the commercial development of the littoral. This was the condition which for centuries made the Malabar coast of India and the Norwegian fiords nests of pirates. The Lebanon country had all the geographic conditions necessary for a pirate coast, with one exception. Trade here was more profitable than piracy, owing to the rich commerce from the Euphrates fords and the desert market of Damascus which forced its way through the mountain passes to the sea. But in Pompey's time, after two centuries of nerveless Seleucid rule in Syria, after the disorganization of the hinterland trade by the successive Armenian and Parthian conquest of northern Mesopotamia, and the diversion of the through Oriental commerce to the Red Sea and Nile route, robber chiefs held many coast cities of Phoenicia and made them pirate bases.[35] Joppa became a notorious haunt, and for this reason was destroyed by Vespasian in 68 A. D.[36]

The normal relation of coast to hinterland is a close interdependence. But in ancient times when the hinterland was impoverished and barred from the sea, and when the littoral itself afforded a slender basis of subsistence, the inhabitants of the seaboard were forced to live by a carrying trade under peaceful conditions, or by piracy, if the unorganized or dis-

[35] Mommsen: History of Rome, Vol. IV, pp. 423-424 and 430. New York, 1905.

[36] Strabo, Bk. XVI, Ch. II, 28. G. Adam Smith: Geography of the Holy Land, p. 138. New York, 1897.

organized state of society so permitted. The balance was easily disturbed and tipped from trade to freebooting at any jar to the social base.

Another common geographic condition was a multiplicity of small harbors and hidden recesses as lurking places for the robber fleets, with numerous headlands as outlook points and strongholds. In this respect the Aegean archipelagoes, the Balearic Isles, and the Illyrian coast were best equipped, because the maze of straits and inlets facilitated escape from pursuit. In this respect they resembled the Bahama Islands off the Florida coast,[37] which were long the hiding place of pirates operating about the Florida Straits and the Windward Passage. They offered the same geographic conditions as the network of sounds and creeks, deposit islands and barrier beaches, forming the embayed coast of North Carolina; there for over a century American pirates lay in wait for merchantmen trading along the coast between the West Indies and New England and did their best to nullify the effects of the obnoxious Navigation Acts.[38] Crete, like Cuba and Jamaica, had an admirable coastline for piratical purposes and nearby island-strewn seas in which its corsairs could safely operate. Lycia, Pamphylia, and Rugged Cilicia (Cilicia Trachea) had an abundance of small hidden ports and rock fortresses[39] but lacked the sheltering islands.

The Caucasus coast of the Euxine (Fig. 1) had nothing to recommend it for piratical purposes, except its poverty of resources and its ship-building timber. Its harbors were very few and badly exposed to the prevailing winds. It had no islands and for long stretches not even a beach. The Caucasus buccaneers, when they returned in autumn from their marauding expeditions, lifted their slender *camarae*, or boats, on their shoulders and hid them in the mountain forest until spring again opened their business season.[40]

All these pirate coasts lay on established trade routes. The robber fleets of the Caucasus swooped down upon the well-laden Greek ships making their usual coastwise voyage to the ports of the Crimean Bosporus, there to exchange wines and cloth for grain and cattle. In the third Mithradatic War, the Pontic corsairs who joined the fleet of the Asiatic king were doubtless recruited in part from this mountainous coast; for thither retreated the last remnants of the pirate bands who, for two years, withstood a Roman siege in Amisus, Sinope, and Heraclea on the seaboard of Asia Minor.[41] During the time of Emperor Tiberius, we find the pirates from this east coast of the Euxine preying upon commerce and pillaging towns and villages of the surrounding lands. They were later reinforced by Scythian corsairs from the Dniester estuary, and in the third century these

[37] David Hanney: The Sea Trader, p. 234. Boston, 1912.
[38] S. C. Hughson: Carolina Pirates and Colonial Commerce, 1670-1740. Baltimore, 1894.
[39] Strabo, Bk. IV, Ch. V, 1, 2, 3.
[40] Strabo, Bk. XI, Ch. II, 12.
[41] Mommsen: History of Rome, Vol. IV, pp. 333-335. New York, 1905.

FIG. 2—The Dalmatian coast of the Adriatic. Scale, 1:4,000,000. (Ancient names in hair-line type.)

"Scythicarum gentium catervae" ravaged the shores of the Propontis and Aegean.[42] The Romans had two lonely stations, Dioscurias and Pityus, on the best harbors this Caucasus littoral could offer; and their remote outpost situation strongly suggests that they were designed to police this lawless coast.

In the Middle Ages the Caucasus pirates were still plying their ancestral trade, though their stock had probably received an infusion of fresh Tatar blood. This time they were looting the richly freighted caravels bound for the Genoese colonies in the Crimea. And again, in the eighteenth and early nineteenth centuries, they issued forth in their poor barks and seized any Turkish or Russian vessels which approached their shores.[43] Hence, Genoa, at some remote date, established a fort at Anapa on this coast for the protection of her commerce. Centuries later, on the ruins of this Genoese stronghold, the Turks built a fort in 1783, and transferred it to the Russians in 1828.[44]

The Aegean pirates, when anarchy reigned on the seas, waylaid ships at the various crossroads of that much-traveled basin in ancient and mediaeval times. The pirate-haunted coast of southern Asia Minor flanked the great Oriental trade track which skirted along this shore and ran thence westward past Rhodes, Crete, and Cythera. These islands afforded choice bases for depredations upon the eastern commerce and also upon the traffic passing in and out of the Aegean. Rhodes, however, seems always to have had both a firm, enlightened government and a strong fleet. Hence, she repeatedly fought the pirates on her own account and supported

[42] Mommsen: Provinces of the Roman Empire, Vol. I, pp. 262-263. New York, 1887.

[43] Chevalier Marigny: Three Voyages in the Black Sea to the Coast of Circassia, pp. 9-10. London, 1837. Translated from from the French.

[44] *Blackwoods Magazine*, Vol. 42, 1837, p. 642.

Rome in its efforts to suppress the evil. Cythera was long a depot of Phoenician pirates. Crete, though its Minoan kings enjoyed the distinction of being the first to put down piracy in the Aegean, became a nest of freebooters so soon as the decline of Greek naval power brought disorder upon the sea.[45] Finally, the extent and flagrancy of their depredations, in co-operation with the Cilician pirates, forced Rome, in 67 B. C., to conquer and annex the island as a police measure. Crete in Saracen hands, from 823 to 960 A. D., again became a formidable nest of corsairs and a great slave market.[46] But the location which made it a desirable pirate base also made it for over four centuries, from 1206 to 1669, the most important commercial base of Venice in eastern waters.

Pompey's famous campaign of 64 B. C. was directed against the pirates who, for nearly forty years (102 to 64 B. C.), had terrorized the Mediterranean, organizing themselves into an international sea power for robbery which embraced the whole basin. They so effectually stopped traffic that dreadful scarcity of provisions prevailed in Italy and especially in Rome, which had come to rely on her oversea grain supply. The buccaneers had their ports of refuge on all the chronic pirate coasts of the Mediterranean from Mauretania to Cilicia, but the latter was their acropolis.[47] Nature had equipped it with every physical facility for the trade—timber, harbors, signal stations, coast fortresses, impregnable mountain retreats.[48] Moreover, its location, remote and inaccessible from the weak Seleucid capital, had placed it beyond reach of the arm of authority and left its people free to follow their marauding bent. Hence the Cilician sea chiefs were the last to hold out against Pompey, and his strong repressive measures against piracy produced here only temporary results. The corsairs of Cilicia resumed activities in the early years of Augustus. One of their tribes, the Clitae, necessitated a Roman punitive expedition in 36 A. D. and again in 52 A. D. In the third century the Cilician pirates emerged as the Isaurians, who from the Cilician mountains plundered on land and sea.[49]

The Adriatic furnished a convenient thoroughfare for piratical operations. Throughout ancient and mediaeval times the rich commerce which traversed this broad marine channel, to and from the ports about the Po mouth, had to run the gauntlet of Illyrian or Dalmatian pirates, whose haunts flanked the sea for four hundred miles (Fig. 2). These freebooters also pillaged vessels sailing across the basin from Italy and ravaged the western coasts of Greece from Epirus to Messina. When their sovereign, Queen Teuta of Scodra, or Scutari, provoked the Romans to punitive operations in 230 B. C., the Illyrian pirates could send out a fleet of a hundred vessels equipped with a force of five thousand men. This first effort of the

[45] Polybius, XIII, 8. Mommsen: History of Rome, Vol. III, pp. 291-292. New York, 1905.
[46] Gibbon: Decline and Fall of the Roman Empire, Vol. VI, pp. 37-38, 46, and 57. New York, 1907.
[47] Mommsen: History of Rome, Vol. III, p. 292; Vol. IV, pp. 307-312, 351-355, and 301-302.
[48] Strabo, Bk. IV, Ch. V, 1-6.
[49] Mommsen: Provinces of the Roman Empire, Vol. I, pp. 363-365. New York, 1887.

Romans to police the Adriatic resulted in the escape of Queen Teuta to Rhizon (Resine) in the marine labyrinth of the Gulf of Cattaro,[50] now the impregnable naval base of modern Austria in these waters; but the treaty of peace excluded Illyrian raids from the southern part of the basin beyond Lissus (Alessio). Fifty years later the founding of Aquileia at the northern end of the Adriatic helped to suppress piracy on those shores.[51] The significant result of Illyrian piracy in these waters was the first interference of Rome in affairs of the Balkan Peninsula, the establishment of Roman naval supremacy in the Adriatic, and the acquisition of certain islands and ports on its eastern shore[52] which were valuable bases for the later extension of Roman power in Greece and Macedonia.

The Illyrian pirates still persisted in their depredations. The robber confederacy which had its capital at Scodra, like its brothers elsewhere in the Mediterranean, was open to engagements as a mercenary fleet. In this capacity it took part in the third Macedonian war against the Romans, and after the battle of Pydna, in 168 B. C., saw its fleet captured and its operations checked for a time. Soon its neighbors, the Dalmatian tribe of pirates, who held the littoral from the Narenta River northward beyond the Cetina, committed such widespread depredations that the Romans sent punitive expeditions against them in 156 B. C., again in 155 B. C. and again in 135 B. C.[53] This last drove the pirate population inland and made them settle in barren mountain valleys where they starved and pined away. But their old haunts on the sea were soon reoccupied by remnants of the tribe, probably reinforced by refugees and outlaws, because the Romans had to punish the Dalmatians again in 119 B. C.[54] In seventy years they so recouped their fortunes and extended their confederacy that, as allies of Pompey, they offered long-continued resistance to the fleets of Caesar sent against them.[55] After order was restored, Imperial Rome established on this coast, at Pola and Salona, her most important Adriatic naval stations, because the opposite Italian coast had no adequate harbors, and she drew from these former outlaw shores the marines to man the imperial navy, just as Austria does today.

The decline of Roman power during the *Völkerwanderung* was followed by insecurity of traffic on all Mediterranean routes. In the Adriatic especially, the growing Venetian commerce of the eighth and ninth centuries and the richly freighted vessels which traveled this long waterway furnished tempting booty for piratical attacks. Geographic conditions were unaltered on the mountainous and island-strewn coast of Dalmatia, but the original Illyrian population had been largely diluted, and at many points even

[50] Polybius, II, 5, 6, 8-12.
[51] Mommsen: History of Rome, Vol. II, p. 372. New York, 1905.
[52] *Ibid.*, Vol. II, pp. 218-9.
[53] *Ibid.*, Vol. II, pp. 437, 505, and 508-509; Vol. III, pp. 421-422 and 426-427.
[54] Strabo, Bk. VII, Ch. V, 4-6, 10.
[55] Mommsen: History of Rome, Vol. V, pp. 103-104, 235-236, 284-285. New York, 1905.

replaced, by the influx of Slavic Serbs and Croatians who poured down to this coast in the seventh century.[56] These interlopers, accustomed to the inland occupations of farming and cattle-herding, abandoned their ancestral callings and adapted themselves to their new environment. They learned from the surviving Illyrians the traditional trade of the coast, became the only expert navigators that the Slav race has ever turned out, and developed buccaneering aptitudes that would have elicited the admiration of old Queen Teuta. Therefore, when the Venetian galleys proved worthy prizes, this new race of freebooters issued from the old pirate haunts at the mouth of the Narenta and along the whole Dalmatian coast. The task of policing the Adriatic against the marauders began in 827 and continued without interruption till the end of the eighteenth century; because the richer grew Venetian trade, the greater was the temptation which it offered to the corsairs.[57]

At first the Venetian fleets were too weak to make effective resistance. They seized pirate ships, to be sure, and carried the Slav captives in such numbers to Venice to be sold as slaves that the race name became the common term for human chattels in western Mediterranean lands; but only a large navy and systematic campaigns against the pirates could remedy the evil. The increased armament necessary for coping with the marauders undoubtedly contributed greatly to the development of Venetian sea power both within and without the Adriatic.[58] Moreover, the necessity of protecting Istria from depredations led finally to Venetian supremacy in that peninsula, while the yet stronger necessity of cleaning out the corsair nests on the whole Dalmatian coastland led to the conquest and annexation of the littoral in 998. This move was imperative, because the pirates had adopted the method of the ancient Illyrians and hired themselves out as a mercenary fleet to the enemies of Venice, who thus found a convenient base in the Adriatic.[59]

But the conquest of Dalmatia did not bring immunity to the Republic. The neck of the Adriatic bottle continued to send forth a stream of wealth that attracted sea-robbers from all parts of the Mediterranean. From 860 to 912, year after year, Saracen corsairs were hanging about the narrow Strait of Otranto.[60] A famous Genoese corsair seized Corfu for a short period as a convenient base, till it was wrested from him by Venice in 1206.[61] After this, in the late thirteenth and during the entire fourteenth century the possession of all the Ionian Islands, which occupied a strategic position near the Otranto gate, was disputed by Venetians and by Greek and Italian corsairs. From this base they ventured into the lower Adriatic

[56] W. Z. Ripley: Races of Europe, pp. 404, 410-414. New York, 1889.
E. W. Freeman: Historical Geography of Europe, p. 118. London, 1882.
[57] W. C. Hazlitt: The Venetian Republic, Vol. I, p. 60. London, 1900.
[58] W. R. Thayer: Short History of Venice, pp. 30-35. New York, 1905.
[59] W. C. Hazlitt: The Venetian Republic, Vol. I, pp. 78 and 106-109. London, 1900.
[60] *Ibid.*, Vol. I, p. 62.
[61] Article "Ionian Islands," Encycl. Britann., 11th edit., Vol. 14, 1910.

for their prey. The Republic maintained her command of the Adriatic only by means of a powerful patrol fleet, which policed the sea for pirates and vessels carrying contraband goods.[62]

The decay of Venice, due to the Turkish conquest of Constantinople and the discovery of the sea route to India, was attended by a decline of her naval power which, from the sixteenth century on, enabled the Dalmatian coast population to resume their piracy. The Adriatic was also scourged by the Tunisian and Algerine corsairs, by Tuscan pirate ships fitted out with Corsican captain and crew, by Maltese Knights of St. John and Florentine Knights of St. Stephen who turned sea-robbers, and even by subjects of the Papal States.[63] With the Barbary and Dalmatian pirates, Venice alternated between conflicts and treaties on a blackmail basis up to the last years of her existence as an independent state.

The appearance of Genoese and Tuscan corsairs during the Middle Ages in Adriatic waters looks like a recrudescence of the ancient piracy which emanated from the Etruscan and Ligurian coasts. Ancient Etruria lacked the essential geographic conditions for chronic piracy, owing to its fertile soil and varied relief; but its location conferred upon it control of the narrow channel of traffic between the islands of Elba and Corsica, and gave it ready access to the rich commerce passing through the Strait of Messina.[64] Undoubtedly this advantageous location, plus the desire to exclude Greek competition from the Tyrrhenian trade, contributed to the persistence of Etruscan piracy. In 482 B. C. we find Anaxilaus, tyrant of Rhegium and Zancle, fortifying the Scyllaeum promontory to prevent the Etruscan sea-robbers from passing through the Strait of Messina; and thirty years later Hiero of Syracuse, who had established his naval power in the Tyrrhenian Sea, sending forth an expedition to ravage the coast of Corsica and Etruria, and to occupy the island of Elba, in order effectually to suppress piracy.[65] The evil recurred sporadically, however, for over a century after this.

Corsica, by reason of its rugged relief, poor soil, indented coastline, and location on marine trade routes, had all the physical qualifications for chronic piracy. To these were added yet another. Its small geographical area, limited population, and political dismemberment, due to its physical dismemberment, all combined to weaken the island and make it a ready prey to every policy of expansion which emanated from the near mainland, whether from ancient Etruria, from Carthaginian, Vandal, or Saracen Africa, from Rome, Pisa, Genoa, or France. To all except the African states, the location of Corsica made it a constant menace if held by a hostile power. Hence, its football political experiences were the persistent result. The free spirit of the mountain islanders made them irreconcilable sub-

[62] P. Molmenti: Venice in the Middle Ages, Vol. I, pp. 117, 121-123, and 130. Chicago, 1906.
[63] David Hanney: The Sea Trader, p. 253. Boston, 1912.
W. C. Hazlitt: The Venetian Republic, Vol. II, pp. 205-206, 261-263, and 309-312. London, 1900.
[64] Strabo, Bk. VI, Ch. I, 5.
[65] Mommsen: History of Rome, Vol. I, pp. 415-418. New York, 1905.

jects under foreign rulers. Hence their constant rebellions through five centuries of Genoese rule, their chronic brigandage and feuds, all together yielded a crop of outlaws who found a ready outlet for their energy in piracy, while hatred for the mainland states gave them motive enough for depredations.[66]

The rugged coast of the Maritime Alps and Ligurian Apennines, with no harbors and few anchorages and only a slender strip of tillable soil here and there, occupied an advantageous position on the ancient line of coastwise traffic between Italy and the Rhône Valley. From the earliest times the Ligurians who held this mountainous littoral systematically pillaged by land and sea.[67] The little Stoechades Islands (Isles d'Hyères), which were cultivated by the Greek citizens of Massilia, were provided with garrisons to ward off piratical attacks, in the days before Imperial Rome brought order in these waters.[68] The Massiliot coast settlements to the west suffered as did the Pisans to the east. And only a century or more of constant conflict reduced the marauders to subjection.[69] By the second century B. C. their raids became intolerable, because they were in a position to threaten Rome's increasing coastwise trade with Massilia, the new *Provincia Romana*, and Spain, which was acquired in 201 B. C.

The Spanish commerce suffered also from buccaneers who had their base in the numerous lurking places of the Balearic Archipelago. These islands had been occupied by the Carthaginians at an early date[70] as advanced outposts against the Massiliots, and long served as stations for piratical descents upon Massiliot merchantmen;[71] for this mode of warfare was more congenial than big conflicts to all representatives of the Phoenician race. After the Punic Wars, these islands continued to be haunts of sea-robbers, until in 123 B. C. the Romans were forced to seize them in order to secure Spanish trade from further molestation.[72]

These islands possessed for the most part a fertile soil and ample fisheries, which together yielded an adequate but by no means sumptuous food supply and inclined the inhabitants to peaceful pursuits.[73] But the frequent appearance of Balearic slingers among the Carthaginian mercenaries during the Punic Wars[74] points to a pressure of population upon the means of subsistence in the home islands which might readily tip the scales in favor of piracy. Furthermore, the abundant coves and hiding-places along their coasts suited to small craft and a location within striking distance of two important trade routes of the western Mediterranean disposed the inhabit-

[66] David Hanney: The Sea Trader, p. 253. Boston, 1912.
[67] Strabo, Bk. IV, Ch. VI, 2-4.
[68] Strabo, Bk. IV, Ch. I, 10.
[69] Mommsen: History of Rome, Vol. II, p. 375; Vol. III, p. 382, note. New York, 1905.
[70] Diodorus Siculus, Bk. V, Ch. 16.
[71] Mommsen: History of Rome, Vol. II, p. 143. New York, 1905.
[72] *Ibid.*, Vol. III, pp. 233 and 291.
[73] Diodorus Siculus, Bk. V, Ch. 17. Strabo, Bk. III, Ch. V, 1, 2.
[74] Polybius, I, 67; III, 33, 72, 83, 113; XV, 11.

FIG. 3—The Barbary coast. Scale, 1:4,500,000. (Ancient names in hair-line type.)

ants to freebooting activities so soon as orderly control of the seas was relaxed; and they likewise attracted both individuals and nations to whom lawless pursuits were congenial. There is a recognized law of such geographic polarity.[75] Thus, the Balearic Isles were seized by the Saracens in 798 and became the haunt of pirates who were attracted thither from all the surrounding coasts. In 1009 they were erected into a separate corsair kingdom, which for over two centuries preyed upon the growing trade of Catalonia near by, especially the port of Barcelona. The Catalans and Pisans participated in a Crusade against the islands, instituted by Pope Paschal II; but not until James I, King of Aragon and Count of Barcelona, conquered and annexed them between 1229 and 1235, were Catalan merchantmen safe on the sea.[76] With the restoration of order, the archipelago became the center of a thriving maritime commerce which justified the wisdom of the ancient Rhodians[77] and Phoenicians[78] in placing trading colonies on these islands.

The rugged mountainous front which Africa presents to the western Mediterranean possesses all the qualifications for a typical pirate coast (Fig. 3), except in the Tunisian peninsula, where alluvial plains and broad intermontane valleys give access to a large and fertile hinterland. Here ancient Carthage found the land base for her great territorial and maritime empire. At several points along the Atlas coast small alluvial plains, like that at modern Oran, Mostaganem, Algiers, and Bona, break the continuity of the mountain rampart bordering the sea and afford a local food supply,

[75] E. C. Semple: Influences of Geographic Environment, p. 160. New York, 1911.

[76] Ulick R. Burke: History of Spain, Vol. I, p. 258. London, 1900.

[77] Strabo, Bk. XIV, Ch. II, 10.

[78] John Kenrick: Phoenicia, pp. 116-118. London, 1855.

but they are barred from hinterland trade. In front of them, on the other hand, from time immemorial have passed fleets of merchantmen, laden with the products of the East, to be exchanged in the markets of Spain; for along this coast ran the great sea thoroughfare of ancient times, leading to the Pillars of Hercules. Hence this littoral in all ages has sent out piratical raiders against the commerce of the western basin and the opposite shores of Europe.[79] Prior to Pompey's great campaign it furnished retreats and markets for the buccaneers who terrorized Italy and Sicily. The Rif coast, whose rugged mountains wall the African front of the Iberian Sea for two hundred miles east of the Strait of Gibraltar, was an incorrigible pirate haunt. Its native Mauri or Berber sea-rovers found a profitable field of operations in the nearby strait and the rich Spanish province of Baetica in the Guadalquivir valley, with its island port of Gades (Cadiz). In the second century of the Empire they repeatedly raided up the river as far as Italica (Seville), in spite of the Imperial troops stationed there to overawe the pirates. Tingis (Tangier) also had a garrison whose main duty was to hold the Rif corsairs in check; but their inroads across the strait into the rich districts of southern Spain continued through the whole imperial period. In Nero's time they caused the Baetica shore to be described as *trucibus obnoxia Mauris*. They were troublesome in the reign of Marcus Aurelius, again under Septimus Severus, and again under Alexander.[80]

The geographical location of the Tunisian peninsula offered facilities for the conduct of wide-reaching maritime trade, when Carthaginians, Sicilian Greeks, and later the Romans maintained order on the sea; or for equally wide piratical depredations, when the decline of Imperial Rome gave free rein to the Vandal kingdom of North Africa. This ill-organized, barbarian community, bent upon spoils more than conquest or power, utilized the nautical aptitude of the local inhabitants and the commanding position of Carthage to pillage all the neighboring coasts from Spain to Venetia and western Greece.[81] Its maritime supremacy was maintained for thirty years during the life of King Genseric, but, gradually declining, was crushed in 533 with the downfall of the Vandal dominion.

The Mohammedan conquest of North Africa in the seventh century brought a new lease of life to piracy on this coast and intensified it by racial and religious wars which prolonged it through a thousand years. The disintegration of the Saracen dominion in Africa into several small states during the fourteenth century and the arrival here of the Moorish exiles from Spain in 1502 lent new motives, both of self-protection and vengeance, to the pirate communities of the African coast. Bougie, Algiers, and Sallee, outside the Strait, became notorious haunts of the "sea-skimmers." Spain, in an effort to police the pirate coast, seized Tunis, Oran, and an island fort

[79] Article "Barbary Pirates," Encycl. Britann., 11th edit., Vol. 3, 1910.

[80] Mommsen: Provinces of the Roman Empire, Vol. I, pp. 73-74; Vol. II, pp. 353. New York, 1887.

[81] Gibbons: Decline and Fall of the Roman Empire, Vol. IV, pp. 1 and 27. Edit. by J. B. Bury, London, 1901.

in the Bay of Algiers, but was soon forced to relinquish them, because new vigor was infused into this whole pirate coast by Turkish corsair captains from the Aegean. They seized Tunis, Algiers, and Tripoli and formed them into military republics living by plunder under a nominal Turkish suzerainty. Here piracy reached its zenith in the seventeenth century but maintained itself till the French conquest of Algiers in 1830, though the Rif pirates continued their raids for several decades. The striking feature of Barbary piracy is its survival long after Mohammedan corsairs had elsewhere abandoned their trade.[82] This was made possible by the rivalry of England, France, and Turkey in the Mediterranean, the maritime weakness of Spain and Italy, the peculiar geographical fitness of the Barbary coast for piracy, and the elements of its population, constantly recruited from robber tribes of the desert and of the Atlas Mountains.

Piracy was a social-economic effect of geographic conditions in the Mediterranean basin, but it produced in turn certain political effects that played no small part in Mediterranean history. Instances have already been given where pirate fleets were employed as a mercenary navy. In all probability those were fleets maintained and trained by piracy which Xerxes drafted into his forces for the Grecian campaign from the shores of Cilicia, Pamphylia, and Lycia.[83] Organized Persian rule offered them a legitimate occupation for their energies. Several centuries later King Tryphon (146-139 B. C.), a usurper on the throne of Syria, encouraged the corsairs of Cilicia and used their help to maintain his position.[84] Spartacus in 72 B. C. relied on the aid of pirates in the Servile War.[85] The buccaneer allies of Sertorius in the Spanish uprising were a match for the Roman fleet, and from their stronghold at Diana on the Artemisian promontory they intercepted Roman supply ships on their way to the army in Spain.[86] Cilician pirates under the leadership of Sertorius attacked the Pityussae Islands off the Spanish coast.[87] In the long-sustained Mithradatic Wars, all the pirate fleets of the eastern Mediterranean were employed by the Asiastic king to reinforce his Pontic and Aegean navies. By their aid he established his supremacy on the sea, almost paralyzed the Roman offensive for several years in the first war and protracted the final conflict in the second.[88] The presence of large bodies of corsairs for hire introduced, therefore, an incalculable factor into many Mediterranean wars.

Constant piratical attacks had an important politico-economic effect upon the states assailed. These found it necessary to build up a standing navy to convoy their merchantmen, protect the home coasts, and destroy

[82] Article "Barbary Pirates," Encycl. Britann., 11th edit., Vol. 3, 1910. Hans Helmolt: History of the World, Vol. IV, pp. 251-254. New York, 1904.

[83] Herodotus, VII, 91-92.

[84] Mommsen: History of Rome, Vol. III, p. 292. New York, 1905.

[85] *Ibid.*, Vol. IV, p. 362.

[86] *Ibid.*, Vol. IV., pp. 282 and 286.

[87] Plutarch: Sertorius, Ch. VII.

[88] Mommsen: History of Rome, Vol. IV, pp. 28, 33-43, 323-324, 333-334 and 351-353. New York, 1905.

the marauding fleets. The increased maritime efficiency and daring which they thus attained reacted favorably upon their merchant marine. In all probability the sea power of Minoan Crete at the time it established its thalassocracy had been developed in part by wars against early Aegean corsairs. Negligent Rome in the last half century of the Republic was driven again and again to refit or supplement or rebuild its rotting fleet to cope with the Mediterranean pirates. Venice, as has been shown, was forced to adopt a big naval program by freebooting neighbors on the Dalmatian coast. Genoa, Pisa, Amalfi, and Barcelona, in their protracted naval wars with the Saracen pirates of the western Mediterranean, built up a sea power which inaugurated or greatly stimulated their successful careers as maritime states.[89]

Constant piratical attacks led not only to reprisals but also to conquest of the lawless coasts in order to police them. The captured ships and seamen went to swell the naval and merchant marine of the victorious nation, thus contributing to its sea power. The newly acquired coasts often proved so valuable as bases for extended maritime trade and military operations, that they whetted the national thirst for farther territorial expansion. Instances of this process have already been given, notably in the case of ancient Rome and mediaeval Venice in their campaigns against the Dalmatian pirates. Spain in the early sixteenth century was drawn by the Barbary pirates into a war which might have resulted in the conquest of the African coastlands, had not Spain's attention been diverted at the time by the wealth of the Americas. James I of Aragon, at the instigation of his commercial subjects of Barcelona, conquered and annexed the piratical Balearic Isles. It was the revival of Barbary corsair activities after the Napoleonic Wars that in 1827 drew the unemployed energies of France to the occupation of Algiers and inaugurated her important North African policy.

The French conquest of the strongest robber state dealt a serious blow to the Barbary pirates. Shortly before they had been chastised by American, English, and Dutch warships. But what whipped them was steam navigation. Their rugged coasts could not breed mechanics and engineers.

[89] Bella Duffy: The Tuscan Republics, pp. 1, 2, 115-117, 23-26 and 34-35. New York, 1893. Articles "Genoa" and "Pisa," Encycl. Britann., 11th edit., Vols. 11 and 21, 1910 and 1911.

GEOGRAPHICAL RECORD

NORTH AMERICA

Success of Canadian Experiments in Yak-Breeding. In 1909 the Duke of Bedford presented six yaks to the Dominion Government with the object of encouraging experimentation in the breeding of a type of animal suited to the more difficult northern portions of Canada and to the western mountain country. They were placed on the experimental farm at Brandon, Manitoba, and remained there until 1912, when they were transferred to a new environment among the mountains at Banff, Alberta. With the exception of the loss of one cow and its calf in 1913 no losses have occurred since the transfer of these animals. These encouraging results in an important experiment in zoögeography promise further development of the plan on broader lines. Through the courtesy of the Dominion Parks Branch, now in charge of the yaks, we are able to include the latest statistics relating to the herd, as follows:

TABLE OF INCREASE OF YAKS SINCE THEIR ARRIVAL AT BANFF

	MALE	FEMALE	CALVES	TOTAL
July, 1912	2	4	0	6
April, 1913	2	4	1	7
May, 1913 (Loss: 1 cow and 3-days-old heifer)	2	3	0	5
July, 1913 (Increase: 1 male and 1 female)	2	3	2	7
April, 1914	3	4	0	7
May, 1914 (Increase: 1 male)	3	4	1	8
June, 1914 (Increase: 1 male)	3	4	2	9
July, 1914 (Increase: 1 female)	3	4	3	10
June, 1915 (Increase: 1 male and 1 female)	5	5	2	12
July, 1915 (Increase: 1 female)	5	5	3	13
September, 1915 (Increase: 1 female)	5	5	4	14
April, 1916	6	8	0	14

Proposed New Map of Yukon Territory. Mr. J. H. Brownlee, the Director of Surveys of Yukon Territory, Dawson, has been instructed by the council, or local governing board, to prepare the necessary data for a new map of the territory. The scale of the new map will be the same as that of the recent base map of Alaska in 1:1,500,000 published by the U. S. Geological Survey. All previous work will be made use of in the compilation, particularly the surveys by the Canadian Geological Survey and the Topographical Surveys Branch of the Department of the Interior, and the recently published survey of the 141st meridian (Alaska-Yukon boundary).

Aërial Transportation in the United States. The value of the aëroplane in military transportation has obscured its utility for civil affairs. That the latter is not entirely neglected is proved by the fact that the U. S. Post Office has invited proposals for the carrying of mail by aëroplane along certain trial routes. Of the eight routes specified one is in Massachusetts; the other seven are in Alaska. The Massachusetts service, between Nantucket and New Bedford, performed by water in five to six hours, should only take fifty minutes by air. More remarkable time saving would be accomplished in the case of the Alaskan routes. The itinerary altogether covers 1846 miles and runs from Prince William Sound to the interior and to the west coast and back, and includes as terminal points Valdez, Fairbanks, Tanana, Kaltag, Nome, Iditarod, Seward, and Anchorage (*Flying*, Vol. 5, No. 2, New York, 1916).

Forest Fire-Weather Warnings in the West. A forest "fire-weather" warning service was inaugurated in the summer of 1913 in the Portland, Ore., and in the San Francisco forecast districts. In 1914 the service was extended to all other forecast districts. The "reasonable success" of these warnings during the period 1913-1915 has resulted in the definite establishment of a fire-warning service as a recognized branch

of Weather Bureau activity. *Instructions No. 26* (April 10, 1916) are as follows: "District forecasters are authorized to issue warnings, to be known as 'fire-weather warnings,' of conditions favorable for the inception of fires in the forested regions of their respective districts." That this new service has already proved of value to the Pacific Slope forest interests is evidenced by the adoption, by the Forestry Industry Conference, at San Francisco, October 19–20, 1915, of a resolution appealing to Congress for an annual appropriation of $10,000 to be applied in strengthening and improving the service. The preamble to the resolution reads as follows: "The usefulness of the U. S. Weather Bureau in forecasting dangerous fire weather is no longer open to question." Mr. E. A. Beals, District Forecaster at Portland, Ore., points out (*Monthly Weather Rev.*, Vol. 44, 1916, pp. 135-138) that forest fires cause an annual loss of about seventy human lives, the destruction of trees worth at least $25,000,000, and the loss of crops, buildings, and live-stock worth many millions more. Warnings of the probable occurrence of winds of sufficient velocity to be dangerous make it possible to increase the fire crews, to stop burning permits, and to take other precautionary measures.

R. DeC. WARD.

EUROPE

Sunshine in the British Isles. A paper by Mr. F. J. Brodie on "The Incidence of Bright Sunshine over the United Kingdom during the Thirty Years 1881–1910" appears in the *Quarterly Journal of the Royal Meteorological Society* for January, 1916. At the close of the decade ending with 1910, the total number of stations reporting sunshine to the Meteorological Office and to the Royal Meteorological Society had reached 198. In discussing the average distribution, the data from 66 stations were utilized, the maps constructed showing the seasonal and annual incidence. The broad features of the distribution show an increase from north to south, with a tendency to coastal maxima and inland minima. There is ample confirmation, even ignoring the records of the large manufacturing towns, for an area of small sunshine over the central parts of northern England. A special examination of the records in London and other manufacturing centers shows a marked deficiency resulting from smoke, more particularly in the winter months. There is evidence, however, that the abatement of the smoke evil has somewhat remedied these conditions in recent years.

R. DeC. WARD.

Sledge Traffic Between Norway and Finland. The February number of the *Review*, discussing Russia's war-time outlets to the sea (pp. 128-132), mentioned sledge traffic between Kandalaksha and Rovaniemi (map on p. 130) as an adjunct to rail transportation. The extent to which Russia is exerting herself to improve her inadequate means of communication in the hour of her trial is manifested once again by the news of the establishment of a winter sledge route between Kirkenes, on Varanger Fiord in northernmost Norway, and Finland. According to a report from the Italian legation in Christiania (*Rapp. dei Agenti diplomatici e consolari*, March, 1916, No. 5, p. 4), the journey between the Norwegian seaport and Kyrö in Finland requires four days. The return trip, however, is made in three days. From Kyrö the road extends as far as Rovaniemi, where rail connection is made. The condition of the road for the entire length favors the journey. A minor traffic is carried on from Bugö, also in Varanger Fiord. Here reindeer are used as draught animals, whereas over the Kirkenes line horses are employed exclusively.

Between 3,500 and 4,000 tons of merchandise are now shipped during the winter season. Each sledge carries between 1,500 and 2,000 pounds. Efforts are made to increase the number of sledges to one hundred and fifty per day. The freight has in the past months consisted largely of cotton for Finnish factories. The line has proved of great value to the industry of Finland in general.

An Old-Established Fair in Modern France. Above Grenoble the left bank of the Grésivaudan Valley is occupied by alluvial fans whose apexes have long been so many crystallization points of population. In the old days it was the agriculture of the lower slopes of the fans that held the population. Now it is industrialism. There is one exception. This is the village of Goncelin, less overshadowed by the mountains and less blessed with resources of "white coal," but more favored agriculturally. Yet agriculture is not Goncelin's distinction. Because it is a center of local roads, situated at a river ford and at the point where one of the main roads for Savoy leaves the valley, Goncelin has always enjoyed a commercial prominence. Its commercial activity, well established at the commencement of the eighteenth century, is concentrated into a system of fairs.

Fairs are held every Saturday of May and June and again in November and December, and a summer fair is held in August. The fairs are in harmony with the

pastoral rhythm of the region. The cattle go up to the mountains for the summer and return to the valley for the winter. The valley farmers, however, seldom move with their flocks but loan them to the hill men. The loan is usually based on a payment in kind, butter and cheese for the milk animals, in silver for the others. It is reckoned that of the three months of estivation the first pays the loan, the second, pasturage and the hire of herdsmen, and the third brings in clear profit. In summer the fabrication of butter and cheese is particularly active, and the summer fair is the "Fair of Cheeses." A special feature of the Goncelin fair is the importation of pigs to supply the local demand. Every peasant of the valley fattens a pig during the summer and kills it in the fall, but he does no breeding. The animal is replaced at the following spring fair. Goncelin's sphere of economic influence is in the main limited to its own region. Cattle represent a commodity most advantageously bought "*au vu.*" The personal and simultaneous presence of buyer and seller, the individual and fragmentary nature of the sales, and the almost exclusive use of ready money are characteristic features. They suit the economic life of the region, and the fair flourishes. To a limited extent the Goncelin fairs attract attention over a wider area. Outside causes are generally determinants in such cases. Thus, in 1909-1910 the great epizoötic that ravaged Italian cattle caused a considerable movement of stock from Goncelin across the Alps.

Unlike most fairs, those of Goncelin are unconnected with religious rite or festival, and the town itself derives little benefit from them. Nomad merchants who establish themselves on the fair grounds are exclusively patronized, and the comparatively short journeys entailed on the part of most of the frequenters of the fairs preclude the necessity for inns. Hence the fairs appear as a very distinct economic phenomenon. (See A. Allix: La foire de Goncelin, *Travaux de l'Institut de Géogr. Alpine*, Vol. 2, No. 3, Grenoble, 1914.)

Russian Fairs. As a vehicle of trade in western Europe the fair has been practically extinguished or unrecognizably transformed: in the east it still remains a prominent commercial feature. Present-day Russia numbers some 16,000 fairs. Most of them, about 87 per cent, are merely local agricultural affairs with a business turnover of under $5,000. These continue to flourish, especially in the more eastern provinces, where communications have been less improved, where population is scanty and capital small. All the larger fairs have declined. Only one per cent of the total number does a business exceeding $50,000, and that of the greatest, Nizhni-Novgorod, placed at $65,000,000, is little more than two-thirds that of the maximum of thirty-five to forty years ago.

Like that of most other famous Russian fairs the history of this greatest one goes back several centuries. From the tenth century the banks of the Volga between the Oka and the Kama have been a meeting ground, pacific and otherwise, for Slav and Tatar. In the mid-seventeenth century the fair acquired a fixed locus under the care of the monastery of St. Macarius. The combination of spiritual and temporal interests was a characteristic feature in the evolution of this form of trading. In the earlier nineteenth century the fair was transferred to its present site 70 miles farther upstream and there became the foremost mart of its kind in the country. The site is ideal. South, the 1,450 miles of the Volga are open to steam navigation. East, the Kama gives access to the Ural provinces, and, west, the Oka extends the Muscovian sphere of influence. North, canal and river make connection with Petrograd and Archangel. The fair occupies the strip of ground lying between the Volga and Oka at their confluence. It is connected with the permanent town on the hills across the Oka by a bridge of boats annually replaced in June and removed on the approach of winter. (For views of the fair, see Figures 2, 3, and 5 of the first article in the April *Review*.) Transactions at the fair depend to a large extent on the nature of the harvest that governs the date of the fair. It is in session from the end of July to the first part of September, though most business is done during the second fortnight of August. Then the temporary population is estimated to amount to four hundred thousand. While the merchandise of the fair remains infinitely varied, some of its former important products have declined in prominence. This is particularly the case with furs, tea, and raw cotton. The opening of the Suez Canal and railroad progress in western Russia reduced the importance of Nizhni-Novgorod as an entrepôt for the overland trade with China. The fur trade has diminished with that of Irbit and others on which it is dependent.

Irbit, ranking second among Russian fairs, is primarily a mart for furs and hides. Twenty or thirty years ago it was estimated to attract approximately a hundred thousand visitors, that is a temporary winter population about twenty times as large as the fixed population of the town. Since the construction of the Trans-Siberian railroad and the growth of direct business between fur companies and foreign markets the fair has

declined, though the high prices and keen demand of the 1916 market sent the gross return on furs up to $1,500,000—nearly double that of the previous year.

Details of the trade may be found in *Commerce Reports* (Nos. 119 and 123, Washington, 1916). A descriptive and statistical article on Russian fairs in general appears in the new Russian-American trade journal *Russia* (The Great Fairs of Russia, *Russia*, June, 1916, pp. 12–23, New York). This may be compared with the account in "La Russie à la fin du 19e siècle" by M. W. De Kovalevsky, Paris, 1900.

AFRICA

The Physical Subdivisions of Southwest Africa. A prompt illustration, in the domain of geographical publications, of the change of sovereignty brought about by the war in German Southwest Africa is furnished by a recent report of the Geological Survey of the Union of South Africa on that one-time German colony (P. A. Wagner: The Geology and Mineral Industry of South-west Africa, *Memoir No. 7*, Pretoria, 1916; [in English and Dutch]). A discussion of the physical divisions of the region forms the most interesting part of the report. This, together with the accompanying map in 1:6,000,000, is mainly based on the text and map of Leonhard Schultze's geography of German Southwest Africa in Hans Meyer's "Das Deutsche Kolonialreich" (2 vols., Leipzig, 1910; section in Vol. 1, pp. 131–298). The following six divisions are established:

The first region, the Namib, is the strip of coastal desert from 15 to 85 miles in width. In topographic expression it varies from a waste-cloaked plain in the neighborhood of Walvis Bay (this is the form of the name now authorized by the government; see Charles Pettman: An Inquiry into the Derivation of Certain South African Place Names, *South African Journ. of Sci.*, Vol. 12, 1915, No. 5) to a series of valleys paralleling the coast on the south. The latter has lately acquired fame through the discovery of valuable diamond deposits. A predominant feature of the coastal belt are the great sand ridges (barchans) piled up by the prevailing south-southwesterly winds to heights that reach 700 feet and constitute a menace to transportation by reason of their rapid movement. Their crest-forms are frequently modified by occasional strong winds from the north. Aridity is the keynote of the geography of the coastal belt. Swakopmund has a mean annual rainfall of 0.89 inches, Walvis Bay of 0.3 inches. Perennial streams reach the coast, but the dry beds of the intermittent torrents will commonly yield water at no great depth. Fogs are characteristic of the immediate shore. To a considerable degree this aridity is due to the cold Benguella Current. The phenomenon in its physical aspects and human responses is comparable with the Atacama Desert of corresponding latitudes in South America. Fish and a deep-rooted species of the pumpkin and melon family constitute the staple food of the tribes inhabiting the Walvis Bay territory (*Journ. South African Soc.*, Vol. 15, 1916), a diet comparable with that of the fish-eating Changos and the Llipis Indians of the Atacama Desert. Marcoy found the latter living solely upon seaweed, water-melons, and shell fish (Travels in South America, Vol. 1, New York, 1875). The small islands lining the shore have been exploited for guano like the Lobos Islands off the Peruvian coast. The prospective value of these deposits was indicated as early as 1861 by the explorer Andersson, to whom we owe an excellent description of the entire Southwest African area (The Okavango River, by C. T. Andersson, New York, 1861). Since 1908 the diamond workings of Lüderitz Bay and the interior neighborhood have introduced problems of water-supply and transportaion similar to those of the Chilean nitrate fields.

From the center of the desert a transition belt leads eastwards to the central highland region of (2) Damaraland. The average rainfall is stated to be 15 inches, but it varies greatly from place to place. At Waterberg a rainfall of 40 inches has been recorded. In years of good rainfall the alluvial soil of the valleys proves excellent for cultivation. Such is the case with the important Windhuk Valley. From the central region isolated ranges superimposed on the plateau run northeast towards Otavi and northwest into the Kaokoveld. Between them and eastward the country merges into the Kalahari Plains. Southward it develops features of the *inselberg* type. South of Damaraland is (3) the plateau of Great Namaqualand, semi-desert and apparently best suited for sheep and ostrich farming. The region is characterized by extensive faulting and great erosion canyons. The dolomite formation of the Otavi region gives a distinct unit, (4) the Karstfeld. The most important of its numerous sink holes is the Otjikoto See, containing in normal years 600 feet depth of water but subject to great fluctuations under varying rainfall. The region is well grassed and the northeastern part appears to be suited to corn and tobacco cultivation, though even here good crops can only be depended on once in three years. Between the northern part of the coast zone and the Kalahari lies (5) the broken country of the Kaokoveld,

forming the dissected rim of the western plateau. Most extensive of all is (6) the Kalahari. The Kalahari includes northern and eastern areas of interior drainage to salt pans; a northeastern zone, the Caprivi Belt, hot and unhealthful, draining to the Zambezi, and a small unimportant tract in the extreme south draining to the Orange River. Over the greater part of the Kalahari the typical topographic form is the sandveld—old dunes evidently formed during times of north or northwest winds and now generally fixed by vegetation. Northward and eastward trees become more numerous and the sandveld gradually passes into tree-steppe.

South African Coast Temperatures. A paper on "South African Coast Temperatures" was read by Dr. J. R. Sutton before the Royal Meteorological Society (London), on February 16, 1916 (*Quart. Journ. Roy. Meteorol. Soc.*, April, 1916). A study of the mean monthly maximum and minimum temperatures for several stations leads the author to the conclusion that the night temperatures of the coast are determined almost entirely by inland conditions, whereas the day temperatures are modified by the sea. An explanation is sought in the lowering of the surface temperature of the sea by the churning effect of the spring gales. R. DEC. WARD.

ASIA

Cyclonic Rainfall in Japan. The distribution of rainfall around cyclones has often been discussed, but a study of the causes which determine this distribution has largely been neglected. Recently, Messrs. T. Yokota and S. Otuki, students in the Science College of the University of Tokyo, have undertaken a statistical investigation of this problem in Japan. The chief data were the Japanese daily weather maps from January, 1905, to December, 1915. The general facts of rainfall distribution over the islands are summarized for various positions of the cyclonic centers. A theoretical discussion of the problem leads to the conclusion that the secondary influences which produce the unsymmetrical distribution of cyclonic precipitation are as follows—(a) the change of temperature with latitude: this tends to locate the center of rainfall on the southeastern side of the low center (in the northern hemisphere) if other conditions are uniform; (b) the temperature contrast between land and water: this influence differs widely according to the season and according to the humidity of the land; (c) the influence of the topography (Torahiko Terada: On the Distribution of Cyclonic Precipitations, *Journ. Coll. Sci. Tokyo Univ.*, Vol. 37, 1916; abstracted in *Monthly Weather Rev.*, Vol. 44, 1916). R. DEC. WARD.

Opening of the First Persian Railroad. Tangible effects of Russia's ever-growing influence in Persia are manifested by the opening, on March 7, 1916, of the first railroad built in the country. The 6½-mile line leading out of Teheran toward Resht, which was built in 1888 and has often been mentioned under the heading of Persian railroads, was in reality nothing more than a street conveyance. Afghanistan now remains the only independent state without a single mile of railway in Asia. According to *Commerce Reports* for April 28, 1916 (pp. 372-373) the new Persian line starts from the boundary with Russian Transcaucasia at Julfa on the Arax River and extends as far as Tabriz, a distance of 93 miles. The ordinary three-day carriage journey between these two points is reduced to a twelve-hour railroad ride. The tracks run parallel to the wires of the Indo-European telegraph system which connects India with European points. The gage adopted is of the broad Russian type, and the line is under Russian management. A branch line diverges westward to Lake Urmiah from the town of Sofian at a distance of 25 miles north of Tabriz.

A readjustment of transportation facilities is likely to follow the inauguration of this line. It is expected that the ancient caravan route of penetration into Persia from Turkey, of which Trebizond was the terminal, will be abandoned in favor of the railway route through Tiflis and other points in the Caucasus. Much of the trade which was conducted through the Persian ports of the Caspian Sea will likewise be deflected toward the railroad. It looks as if Tabriz will be converted, during the next few years at all events, into the great entrepôt, not only of Persia, but of the whole plateau of Iran.

The prolongation of the line south and east from Tabriz may follow without great delay. The objectives are connection with the Indian railway system in Baluchistan and extension to the shores of the Persian Gulf. The important towns of Hamadan, Teheran, and Isfahan lie in the path of these extensions.

POLAR

Mikkelsen's Explorations in Northeastern Greenland. Mikkelsen's expedition of 1909-1912 was sent out to find the records of the ill-fated Mylius-Erichsen expedition of 1906-1908. Lieutenant Trolle's brief and striking account of the original expedition

(*Geogr. Journ.*, Vol. 33, 1909, pp. 40-61) aroused widespread interest. The fate of the leader was known, but it was hoped that his diaries and sketches might still be recovered; and it had not been determined where he made his last camp. Mikkelsen's first report (*Geogr. Journ.*, Vol. 41, 1913, pp. 313-322) contained his chief results. In the same year he published a book entitled "Lost in the Arctic" (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 45, 1913, p. 862). His final report, entitled "Report on the *Alabama* Expedition to North-East Greenland, 1909-1912," has now been published and reaches the Society as a reprint from *Meddelelser om Grønland* (Vol. 52, pp. 1-143, Copenhagen, 1915).

Though his main object was to recover the note-books and other records of the Mylius-Erichsen expedition, there was time for a large amount of sketching and observation. The report has therefore great scientific value.

On Mikkelsen's first search expedition the grave of Brönlund was found where Koch had buried him in 1908; but nothing was found of either Erichsen or of Hagen, who died with him.

The second search expedition was one of the most daring in the history of Arctic exploration. Mikkelsen's plan was to sledge from Shannon Island (75° N.) to Danmark Fiord (81° N.), on the extreme northeast coast of Greenland, by way of the inland ice, then around Northeast Foreland and down the outer coast where Mylius-Erichsen did his survey work, and back to Shannon Island (for the northern part of this area see the map in the June *Review*, p. 450, and the small map illustrating the item below). The distance was about 1,400 miles, with only five depots on the way and these far apart. Mikkelsen gives a detailed account of his plans, equipment, and food supplies. Of the five men in the party only Iversen was to accompany him to Danmark Fiord and back. These two men made about three-fourths of the journey alone.

Mikkelsen hoped to find the bodies of the two explorers and their records on his way back south; meanwhile there was a chance that he would recover records they might have left, possibly in Danmark Fiord. For a long distance north he chose the inland ice as a highway. The undulations in the surface of the ice made it a rugged sledge route. The ice slopes towards the coast and is gullied into deep channels by large streams of water. Nunataks diversify the landscape for half the route between the point where the party struck the main ice sheet northward to its termination at the head of Danmark Fiord. They are ringed with crevasses and in turn crossed at right angles by still deeper cracks that converge toward the nunataks. The elevation of the inland ice along the line of traverse was from 2,000 to about 3,500 feet above the sea.

On emerging from the inland ice Mikkelsen followed the western shore of Danmark Fiord. Here he found, several journeys apart, two cairns, each containing a statement of progress by Mylius-Erichsen, which are reproduced in facsimile in the report (Pls. VII and VIII). In the earlier of the two letters, dated August 8, 1907, Mylius-Erichsen described his journey westward to Peary's Cape Glacier and his discovery that "Peary Channel does not exist; Navy Cliff is connected by fast land with Heilprin Land. We renamed Independence Bay 'Independence Fiord' and built a cairn (with report) on a low point near Cape Glacier. On the way out through the fiord we discovered and investigated two side fiords, 'Brönlund's fiord' towards the northwest and 'Hagen's Fiord' towards the southeast" (p. 86). Mikkelsen gives much space to an attempt to reconstruct the probable route of Mylius-Erichsen to the place where he and Hagen died. He believes they perished in a fiord in the northern part of Lambert Land and that their bodies and their records sank with the melting of the ice.

The report notes the comparative sparsity of vegetation and animal life on the east coast in latitudes corresponding to the Cape York-Etah regions on the west coast, where animals and especially birds are numerous. An extraordinary abundance of life is noted at the edge of the great ice cap. "We had expected to find a very desolate country when we came down from the inland ice, but we were agreeably surprised to find a vegetation so luxuriant that we had seen nothing like it north of Danmark's Havn.

"Large tracts were covered by a layer of moss, so thick that it felt quite elastic under our feet, and furthermore we noticed several kinds of grasses, some of which had a length of 30 centimeters and covered areas so large that they gave the impression of fields. Not only the valleys but also the slopes of the hills were quite covered with vegetation, moss, grass, heather, and willows, the trunks of which were as thick as a thumb and a decimeter high.

"A large number of animals found their means of existence on this luxuriant vegetation, and the first traces of animal life we found only 25 meters from the foot of the snow-bank over which we came down" (p. 68).

Peary found many traces of former inhabitants in northeastern Greenland, and the Danish expeditions have greatly extended the first meager observations. In addition, Mikkelsen notes their former occupation of Pendulum Island and Bass Rock, lati-

tude 74½° N. Those in the north, 81° to 82° N., appear to have depended chiefly on an abundance of musk-oxen. Those in the south probably depended to a greater degree upon the sea. A number of fox traps, meat caches, shelters, and tent rings were investigated. In eastern Greenland traces of former Eskimo habitations coincide almost everywhere with the limits of range of land animals, and these in turn depend upon ice-free land a part of the year and at least a thin cover of vegetation. This fact lends great interest to the large extent of ice-free slopes in Peary Land where the northern limits of former Eskimo occupation may some day be traced.

Revised Survey of the Head of Danmark Fiord, Northeastern Greenland. Danmark Fiord is the deep re-entrant whose waters wash the western shore of the peninsula which juts farthest seaward from Greenland's northeastern coast. The true proportions of this major depression have only now come to be realized, as a result of surveys made by Mikkelsen on the expedition described in the preceding note. From the inland ice to the mouth of the fiord its axis measures about 115 miles. This, in Greenland, makes it comparable only to the adjoining Independence Fiord, about 105 miles long according to Rasmussen's recent determination of its head (see the June *Review*, p. 449, and map, p. 450), and the dendritic fiord region about Scoresby Sound on the east coast in 70° N., and places it among the world's longest fiords (Sogne Fiord, Norway, 112 miles; Lynn Channel-Chatham Strait, Alaska, 230 miles).

FIG. 1—Sketch-map showing revised survey by Mikkelsen of the head of Danmark Fiord, based on *Meddelelser om Grønland*, Vol. 52, Pl. I. Scale, 1:3,850,000.

The map on the same scale in the June *Review* (Vol. I, p. 450) should be corrected accordingly for this region.

Its representation on a map goes back to Lieut. N. P. Høeg-Hagen's survey in 1907 on the Mylius-Erichsen expedition. The only form in which this survey has been preserved is in two rough pencil drawings, which are reproduced in facsimile as Plates IV and V of *Meddelelser om Grønland*, Vol. 51, No. 1, 1913. The two drafts are on the same scale (1:500,000) and of the same area: the earlier (Pl. V) is, however, somewhat fuller and shows the sights taken from the various observation points as well as the extent of the inland ice, while the latter, cleaner draft (Pl. IV) gives the coastal outline only and the names of the larger geographic features. These maps were found with the Eskimo Brönlund's body on the search expedition led by Lieut. J. P. Koch in March, 1908, that determined the tragic fate which, the November before, had overtaken Mylius-Erichsen and his two companions, Hagen and Brönlund. They were not intended to serve as the final maps. When, in their last straits, the three men realized, however, that they might not be able to reach the ship, it is probable that they so divided the records among themselves that, whoever survived, the main results of their work would reach the outside world. Brönlund carried his own diary and the two rough maps. These, together with the two letters of Mylius-Erichsen which Mikkelsen found, as related in the previous item, are the only available sources for the geography of Independence and Danmark Fiords, the most important region explored by the expedition.

In view of the preliminary nature of Hagen's maps, it is not astonishing that they have developed to be incorrect with regard to a portion of the area. On Mikkelsen's sledge journey north in the spring of 1910 (see preceding item) he descended from the inland ice by way of Danmark Fiord. He thus had an excellent opportunity to survey the region about the head of the fiord. His survey is laid down on a map in 1:650,000 constituting Plate I of Volume 52 of *Meddelelser om Grønland*, published in 1915, which is reduced in the accompanying figure (according to which the corresponding portion of the map in the June *Review*, p. 450, should be corrected). The salient

point is that Mikkelsen shows the head of the fiord to trend in practically the same direction as its lower part, i. e. north-northeast, while Hagen represented it as occupying an east-west position. The account given in Mikkelsen's report (*op. cit.*, pp. 77-78) of the methods of surveying used and the checks applied leave no doubt as to the correctness of his representation. As showing Mikkelsen's original faith in Hagen's map it may be mentioned that the map accompanying both his preliminary account and his book (see preceding item) in each case shows the head of the fiord oriented according to Hagen, a circumstance which forced Mikkelsen to swing the representation of his route over the inland ice westward in order to strike the fiord at the proper point. At that time Mikkelsen's observations had probably not been worked out with the finality which characterizes the present report.

The question naturally presents itself, How is it that Hagen's map, which otherwise has proved so correct in spite of its general and sketchy character, should be unreliable with regard to this region? The facsimile (Pl. V) suggests a possible explanation. The line of sight shown on it radiating from the observation point near Gundersteddal on the western shore of the fiord (see the accompanying figure for place names) include two bearing south-southwest. One of these, if prolonged, strikes Cape Viborg on the eastern side of the fiord. The other, which forms an angle of only 3° with the first, is only half-heartedly drawn and, if prolonged, strikes no prominent point. It might be that, with the primitive means at Hagen's disposal—some of the sights are evidently not even drawn with a straight-edge, but freehand—these two lines were meant to represent the same sight and it was a matter of chance as to which one was used. The position of Cape Viborg was, it seems, determined by the intersection with a sight from an observation point a little farther south, near Pinseskaeret Island. If the first line of sight from Gundersteddal be selected, the sight from Pinseskaeret intersects it at a point which would give Cape Viborg a position 10 kilometers farther north, in close agreement with Mikkelsen's determination. If now the few sights that Hagen was able to take in the uppermost section of the fiord were tied up to the position of Cape Viborg as he had drawn it, instead of where it actually lies, then this alone would account for a shifting of the axis of the upper fiord by about 30° to 40°, or from east-northeast to north-northeast.

In any case, the fact that the region lies on the outer edge of the area surveyed and that its representation is based on long sights and acute intersections would sufficiently account for the possibility of error. The error consists, it should be noted, mainly in faulty orientation of the whole area; the details are in general correct.

This latter point is illustrated by the region above the head of the fiord. On Hagen's earlier draft (Pl. V) a valley is shown parallel on the north to the head of the fiord and draining a small lake above. On his later draft (Pl. IV) this lake has lengthened to 75 kilometers and is designated Fyn Lake (Mikkelsen uses "Fyen"; both are native forms for the Danish island of Funen, after which the lake was evidently named). Although Amdrup in his discussion of the maps (*op. cit.*, Vol. 41, p. 222) designates Plate IV as the later and more carefully executed version and has used it as the basis of the official map of the regions explored by the expedition (*op. cit.*, Vol. 46, No. 2, Pl. IV, 1:1,000,000) he makes an exception for the lake and here follows Plate V. Mikkelsen's expedition, however, has shown that Hagen's later chart (Pl. IV) was substantially correct. There is a lake here, some 28 miles long and from 2 to 5 miles wide. It draws its waters from the melting of the inland ice, at which it heads, and is separated by a morainic dam from Danmark Fiord.

GEOGRAPHICAL NEWS

Personal

Prof. Joseph Barrell of Yale University received the honorary degree of Doctor of Science at Lehigh University on the occasion of the commencement exercises in June celebrating the fiftieth anniversary of the founding of the institution.

Rev. T. A. Bendrat, known for his geographical and geological work in Venezuela, started in July on an expedition to the headwaters of the Orinoco River to explore its sources and the surrounding region.

Dr. Frank M. Chapman of the American Museum of Natural History has left on an expedition to the Andes for the summer to secure the setting for habitat groups of several birds in South America, including the condor and the rhea. Doctor Chapman is accompanied by Mr. George K. Cherrie and Mr. Leo E. Miller. Mr. Miller, it will be recalled, contributed an article on the Gy-Paraná River to the March number of the *Review*.

DR. JOHN M. CLARKE, state geologist of New York, received the honorary degree of Doctor of Science at the quarter-centennial celebration held at the University of Chicago, June 2-6.

DR. J. WALTER FEWKES of the Bureau of American Ethnology is engaged in archaeological and ethnological field work northeast of the Hopi villages in northern Arizona.

PROF. A. W. GRABAU at the annual dinner of the Geological Journal Club, Columbia University, on May 17, was presented by the students and members of the departmental faculty with a copy of Suess's "The Face of the Earth" in commemoration of the completion of fifteen years of active service as a teacher in Columbia University and as a philosophic student of geology.

PROF. H. E. GREGORY of Yale University spent the winter of 1915-1916 in the Australian deserts. In June he returned to New Haven.

PROF. J. W. HARSHBERGER of the University of Pennsylvania conducted an illustrated science conference on "Field Research in Plant Geography and Ecology" on April 22 at the Brooklyn Institute of Arts and Sciences.

SIR THOMAS H. HOLLAND, F.R.S., professor of geology in the University of Manchester, has been appointed chairman of the commission which the British Government is forming to survey the economic resources and industrial possibilities of India.

DR. C. F. MARBUT, Chief of the Bureau of Soils of the U. S. Department of Agriculture, received the degree of Doctor of Laws at the commencement exercises of the University of Missouri in June.

PROF. T. P. SAVAGE and DR. F. M. VAN TUYL of the department of geology of the University of Illinois are engaged on a geological expedition to Hudson Bay to last until the middle of September. The region south of the Churchill River will be examined.

MR. J. W. SLAUGHTER, recent lecturer on sociology at the University of London, gave a paper on "Is There a Need of More Reality in the Elementary School Curriculum in History and Geography?" before the meeting of the National Educational Association in New York City, July 1-8.

MR. R. F. STUPART, Director of the Meteorological Service of Canada, received the honor of knighthood on the occasion of King George's birthday.

OBITUARY.

COMMANDER H. L. L. PENNELL, who was killed in the naval battle of Jutland Bank on May 31, was one of the officers of the *Terra Nova* of the British Antarctic Expedition of 1910.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in the July number, pp. 77-81

NORTH AMERICA

UNITED STATES

Western States

CORY, H. T. **The Imperial Valley and the Salton Sink.** With introductory monograph by W. P. Blake. xiii and 439 pp. (pagination not consecutive); maps, diagrs., ills. John J. Newbegin, San Francisco, 1915. $3.50. 9 x 6.

Although this volume is in part a compilation, its main feature is a paper entitled "Irrigation and River Control in the Colorado River Delta," read by the author before the American Society of Civil Engineers (the 368-page reprint of which from Vol. 76 of the Society's *Transactions* is, with its own pagination, bodily incorporated). It deals with the engineering problems incidental to the development of what may without undue exaggeration be described as one of the potentially richest regions within the confines of the United States. Mr. Cory was prominent in rescuing the reclamation project from the impending overwhelming disaster which threatened it for a while and resulted in the formation of the present Salton Sea. Although this portion of the book was written primarily for a technical audience, it brings out clearly the various problems which faced those who were responsible for and those who overcame the threatened destruction. Lack of adequate knowledge concerning the behavior of the Colorado in its seasons of flood, restriction of choice in the site for the diversion works, and the imperative necessity for supplying an ever-growing population with a constant supply of water for its domestic and agricultural needs were the factors which, in combination with unusual floods, caused the irruption; and the need for rapid decision and action when the situation was almost beyond control was responsible for the heroic but unorthodox methods employed for closing the break. The author sounds a note of warning as to the importance of safeguarding the valley in the future by comprehensive storage projects upon the upper Colorado and a working agreement with Mexico for its control in the delta.

Of the contributed papers and abstracts which form a part of the volume the most notable is one from the pen of the late Professor W. P. Blake, who first examined and reported upon the Colorado Desert in 1853. Professor Blake was one of the true scientific pioneers of the West, standing amongst the highest in his chosen domain of economic geology, and his paper proves how accurate was his original estimation of the physiography and potentialities of this new region.

Professor Blake's paper was originally prepared at Mr. Cory's request to accompany his article on the Colorado delta. The publication by the Carnegie Institution of a monograph on the Salton Sea in 1914 (*Publ. No. 193*, reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 885-886) made its inclusion in that volume desirable, and the proper permission was secured. As there published some sections were omitted, while the present version is complete. In turn, the present volume has borrowed from the Carnegie Institution's publication Dr. W. H. Ross's chapter on the chemical composition of the water of Salton Sea and the reviewer's notes on the geographical features of the Cahuilla Basin, of both of which abstracts are given.

The memory of a western community concerning its own inception and development is in general but a fleeting and inaccurate one, and it is well that the record should have been made in this case, both as a statement of important facts and an accessible source of valuable data, when the progressive upbuilding of the deltaic region shall bring about the seemingly inevitable struggle with the Colorado for final supremacy.

GODFREY SYKES.

GODDARD, P. E. **Indians of the Southwest.** (Handbook Series, No. 2.) 191 pp.; maps, diagrs., ills., index, bibliogr. American Museum of Natural History, New York, 1913. 50 cents. 8 x 6.

A clearly written and amply illustrated outline of the leading features of southwestern ethnography. The introduction, in giving a brief environmental setting, points

out the isolation of the Southwest—cut off on practically all sides by natural barriers: by the Staked Plains from the culture of the Great Plains; by the desert country of northern Mexico from the home of Aztec civilization in the Valley of Mexico; by the Colorado River and Desert from the culture area of the Californian coast; and by mountain barriers from the Ute of the Great Basin. Separate chapters are devoted to the Pueblo peoples, ancient and modern, and the nomadic peoples, the latter term including all non-pueblo-dwelling tribes, i. e. those belonging to the Athapascan, Piman, Yuman, and Shoshonean linguistic stocks. In conclusion there is a short discussion of the origin and relations of the two entirely dissimilar cultures embraced in the single region of the Southwest. They represent two solutions of the problem of adjustment to environment in an arid region and show relations analogous to those existing between the nomad bedouin of Syria and Egypt and the settled *fellahin* of the oases.

BARTELL, M. J., AND R. P. MCINTOSH. **California rainfall and runoff and recent floods.** *Engineering News*, Vol. 75, 1916, No. 15, pp. 686-688.

BURKE, EDMUND, AND R. M. PINCKNEY. **A report on Montana climate.** 65 pp.; maps, diagrs. *Montana Agric. College Exper. Sta. Bull. 55.* Bozeman, 1914. [Diagrams and tables, with discussion, of precipitation and temperature, with emphasis on the former. There are diagrams giving the monthly average precipitation by five-year periods from 1891 to 1910 at 20 to 38 stations according to the number existing at the time.]

BUTLER, B. S., AND V. C. HEIKES. **Notes on the Promontory district, Utah.** 10 pp.; map, diagr. *U. S. Geol. Surv. Bull. 640-A.* Washington, 1916.

BUTLER, B. S., AND G. F. LOUGHLIN. **A reconnaissance of the Cottonwood-American Fork mining region, Utah.** With notes on history and production by V. C. Heikes. Map. *U. S. Geol. Surv. Bull. 620-I*, pp. 165-226. Washington, 1915.

CAMPBELL, D. H. **Plant distribution in California.** Ills. *Scientific Monthly*, Vol. 2, 1916, No. 3, pp. 209-225.

DANIELS, MARK. **The Grand Canyon of the Colorado.** Ills. *Amer. Forestry*, No. 268, Vol. 22, 1916, pp. 202-208. [Touristic description by former superintendent of National Parks.]

DURST, D. M. **Physiographic features of Cache Creek in Yolo County.** Maps, ills. *Univ. of California Publs. in Geogr.*, Vol. 1, 1916, No. 8, pp. 331-372. [Cache Creek is an antecedent stream draining Clear Lake eastward into the Sacramento Valley. The headwaters lie well to the west of the main crest-line, differing in this respect from any other stream of the Coast Range.]

DURY, CHARLES. **Natural history notes of southern Arizona.** *Journ. Cincinnati Soc. of Nat. Hist.*, Vol. 22, 1916, No. 1, pp. 4-13.

HILL, J. M. **Notes on the fine gold of Snake River, Idaho.** Map, diagr. *U. S. Geol. Surv. Bull. 620-L*, pp. 271-294. Washington, 1915.

LEE, W. T. **The Aztec gold mine, Baldy, New Mexico.** Map, diagrs. *U. S. Geol. Surv. Bull. 620-N*, pp. 325-330. Washington, 1916.

—— **Los Angeles County in California, Flood control in—I.** Map, diagrs., ills. *Engineering News*, Vol. 75, 1916, No. 6, pp. 272-275. [Abstract of a report of the board of engineers.]

—— **Oregon, Water laws of the state of, compiled from Lord's Oregon Laws and Session Laws of 1911 and 1913.** 195 pp. State Water Board, Salem, 1913. [There has been an enormous amount of litigation in the semi-arid West over water rights, as in every dry region of the world where there is a limited supply of water for irrigation. Both ground water and surface water have been the subject of grave dispute. Conflicting judicial decisions have given added trouble. The Oregon water rights were recently codified, and it is now possible to deal with such questions more fairly. Neighboring states have taken similar action and after due notice have finally settled old questions of water rights. There is a great deal of useful geography in this primarily legal document.]

PARKER, G. L., AND F. B. STOREY. **Water powers of the Cascade Range, Part 3: Yakima River basin.** 169 pp.; maps, diagrs., ills., index. *U. S. Geol. Surv. Water-Supply Paper 369.* Washington, 1916. [Sections by Edwin J. Saunders on geologic history, physiography and river history, climate and production of coal, and by Philo M. Wheeler on the settlement and development of the Yakima River basin.]

REED, W. G. **Report of the meteorological station at Berkeley, California, for the year ending June 30, 1914.** Maps, diagrs., ills. *Univ. of California Publs. in Geogr.*, Vol. 1, 1916, No. 9, pp. 373-439.

ROBBINS, E. C. **The lumber decline in the Northwest.** Ills. *Amer. Review of Reviews*, Vol. 53, 1916, No. 5, pp. 583-588.

STEBINGER, EUGENE. **Geology and coal resources of northern Teton County, Montana.** Maps. *U. S. Geol. Surv. Bull. 621-K*, pp. 117-156. Washington, 1916.

—— ***Maricopa, Arizona, sheet.*** [***Topographic map of the United States.***] 1:62,500. Surveyed in 1903-1904 and 1913; edition of Sept., 1915. U. S. Geological Survey, Washington, D. C. [A portion of the Open Basin region of Arizona, showing striking contrast between steep and rugged mountain ranges and the nearly flat-floored intermontane basins. The abrupt transition from the one type of topography to the other is beautifully shown along the base of the Estrella Range and appears to good advantage in the photograph of the range forming Plate II of Willis T. Lee's paper on "The Underground Waters of the Gila Valley," *U. S. Geol. Survey Water-Supply Paper No. 104*. Both contour map and photograph suggest that the Estrella Range is an exceptionally good example of a maturely dissected block mountain, but no hint as to origin occurs in Lee's description.—D. W. J.]

—— ***(1) Maine Prairie, (2) Dixon, and (3) Saxon, California, sheets.*** [***Topographic map of the United States.***] 1:31,680. Surveyed in 1906; edition of 1916. U. S. Geological Survey, Washington, D. C. [Three adjoining sheets representing the floor of the Great Valley of California not far from the mouth of the Sacramento River. The extreme flatness of the surface is remarkable, the few contours on a five-foot interval failing to show any irregularities of importance. Railroads, roads, and county boundaries seldom deviate from straight lines.—D. W. J.]

MEXICO AND CENTRAL AMERICA

ALFARO, ANASTASIO. **La invasion de langosta.** 7 pp. Reprint from *Rev. de Educación*, 1915, Oct. San Jose, Costa Rica. [Locust ravages in Costa Rica.]

BARROS, C. R. **Nota del consul general de Chile en Panamá sobre el tránsito en el Canal durante el mes de agosto último.** *Bol. Relaciones Exteriores*, No. 63, 1915, Dec., pp. 45-49. Santiago, Chile. [Specifies the Chilean share in Panama Canal traffic.]

—— **Costarica, Repubblica di, Commercio d'importazione ed esportazione fra la, e l'Italia nel 1914.** *Rapporti dei Agenti Diplom. e Consol.*, 1916, March, No. 5, pp. 1-2. Direz. Gen. degli Affari Commerciali, Minist. degli Affari Esteri, Rome.

HILGARD, K. E. **Ueber Geschichte und Bau des Panama-Kanales.** 113 pp.; maps, diagrs., ills., bibliogr. Art. Institut Orel Füssli, Zurich [1915†]. 7 fr. 9½ x 6½. [Emphasis mainly on engineering phase; there is, however, a section on world commerce and how it is affected by the canal.]

—— **Mexico: Its political situation, its resources, and its military strength.** Map, ills. *Scientific American*, Vol. 114, 1916, No. 16, Apr. 29, pp. 450-451, 456, and 457.

—— **Panama Canal, Governor of the, Annual Report for the fiscal year ended June 30, 1915, of the.** xix and 555 pp.; ills.; diagrs. and maps in separate portfolio. Washington, 1915. [The maps include one showing the East and West Culebra and Cucaracha slides on July 1, 1915.]

SANDBERG, H. O. **Central America of to-day—Guatemala.** Ills. *Bull. Pan American Union*, Vol. 42, 1916, No. 2, pp. 218-236.

SOUTH AMERICA

ECUADOR, PERU, BOLIVIA

GREGORY, H. E. **A geologic reconnaissance of the Cuzco valley, Peru.** Maps, diagrs., ills. *Amer. Journ. of Sci.*, No. 241, Vol. 41, 1916, pp. 1-100.

The three chief features of this report are (1) geologic observations, (2) maps, and (3) physiographic facts and interpretations. The geologic data are unusually full and detailed and will prove useful to future students in the interpretation of the geology of the Cuzco region. The topographic map by Bumstead is possibly the best that has ever been made of any part of Peru and forms one of the many valuable results of Professor Bingham's Peruvian expeditions. The physiographic facts and interpretations are disappointing. There are a number of contradictions in critical places in the argument and several serious errors of statement. A mature cycle associated with a relief of thousands of feet could scarcely run its course and leave merely

a few hundred feet of lake sediments on the floor of a structural depression, the present Cuzco basin. Where did the greater part of the sediments go and under what conditions? Did the water leaving the lake bear sediments? There are many assertions with grave implications on pages 36-38, but what is the evidence? At the end we are told that the ancient lake in the basin still awaits investigation. On page 23 there is no distinction made between terraces to retain soil and terraces built primarily to secure irrigable surfaces. The statement on page 8 that "in the latitude of Cuzco . . . . the term Eastern Cordillera and Western Cordillera have little significance" is based upon lack of knowledge. There are available good descriptions which certainly deny this statement of fact. If for *latitude* we should read *longitude,* scores of photographs and a number of maps prove the contrary.

The block diagram, Figure 9, purports to be "based on topographic data from all available sources." Yet in it the Cordillera Vilcapampa is practically extinguished, and the great chain of volcanoes resting on thousands of feet of lava between Cotahuasi and Antabamba is not represented at all. It is contrary to fact to say that the Peruvian plateau is studded with snow-capped peaks (p. 18); and that it is merely "an uplifted erosion surface" (p. 19). On the west (at Cotahuasi) are over a mile of lavas resting on an erosion surface of rugged relief. The top of the lava series is a volcanic plateau of great extent, now in a first cycle of erosion, and still extremely youthful. A chain of volcanoes surmounts it. The most serious criticism relates to the extension over large portions of the Peruvian Andes of conclusions that have a distinctly local application.

EUROPE

General

FROBENIUS, HERMAN. **Abriss der Militärgeographie Europas. I. Teil: Die Halbinseln des Mittelmeers.** 137 pp. *Ergänzungsheft zu Petermanns Mitt. No. 184.* Justus Perthes, Gotha, 1915.

Since the present world war is causing us to look at all things through military glasses, so to speak, Lieutenant Frobenius' paper on the military geography of Europe is most timely and will be widely read.

Military geography is considered first in its relation to the other sciences. Then about one-fourth of the paper considers in detail the relation between physiography and military strategy, illustrated by numerous examples and discussions from past wars. Chapter II gives a general survey of Europe as regards geographical location, frontiers, climate, mountain and river systems, traffic lines, theaters and operations of war. The remainder of the paper gives a detailed description of the peninsulas along the Mediterranean, considered in four parts or regions, viz., the Pyrenees and the Iberian Peninsula, the Alpine territory, the Apennine Peninsula and islands, and the Balkan Peninsula. The last two regions are of special interest since they are within the zone of present military operations. The continuation of this study to include the other parts of Europe will be eagerly awaited.

Military geography and political geography are sister subjects. Both must be built up from geography and history as a common foundation. Military geography and a knowledge of terrain are related to each other in the same way as strategy and tactics. The former considers the geographical conditions of the entire theater of possible military operations as a whole; the latter considers in detail topographical and other conditions of a locality in which troops must operate.

The theater of war in its widest sense is the entire territory which may become the field of operations of belligerent forces. It comprises land territories, high seas, navigable waters of belligerents, and frequently territory of weak neutrals. With a common land frontier, the territory between the boundary and the capital usually forms the principal theater. If, however, the boundary is extended, several distinct regions may become theaters of operations. The theater of war is frequently influenced by other than spacial relations. A war may be waged with several not distinctly united adversaries as well as on several fronts. Such a condition is very general among the middle European states, as is the case at present. On the other hand, countries separated from one another by almost insurmountable territorial obstacles may be brought into co-operation by a common speech or origin.

The location of the theater of war is influenced by many considerations, chief among which is climate, which may be modified to some extent by existing fuel supply. Density of population also affects movement, care, and supply of troops, as operations on a large scale always require a large population and an ample source of supplies. The extent of the theater of war is governed by the available highways, railroads, and waterways along

which all movements must take place, and the movements themselves grow complicated in direct ratio with the irregular network of facilities available to either belligerent. On highways the rate depends upon the physical condition of the troops, the character of the roads, and the weather; on waterways and railroads according to the available supply of transportation. These routes are intersected by rivers, marshes, mountains, forests, etc., which further complicate movements. The particular territory which is made the theater of operations depends upon the will of the belligerent who assumes the offensive.

Land frontiers, such as mountain ranges and river courses, which offer natural interference to free and uninterrupted traffic, constitute a real strategic barrier, whereas open frontiers constitute a mere political boundary line. Nevertheless, the latter cannot be disregarded, for peace-time concentrations along such frontiers may be the precursor to aggressive hostile operations. Mere political boundaries are only a product and symbol of peace and may shift during and as a result of each war. The determination of the boundary line presents many difficulties due to attempting to co-ordinate political and physiographic features.

In any actual case favorable and unfavorable conditions of both a natural and an artificial character will be found mingled in an extraordinary variety, and generalizations will be found impossible. There must be considered particularly the relative advantages and disadvantages of mountainous districts, watered and cultivated areas, wooded areas, and land cut up by ditches or canals which may enable it to be overflowed. Mountain passes are strategic places because the invader can pass high ranges only at the passes. Important depots or fortified places on or adjacent to lines of supply have a controlling effect upon operations in their districts. The capital of a country is usually the principal objective on account of the moral effect of its fall and the attendant confusion of the governmental machinery. JAMES GORDON STEESE.

AFRICA

SAHARA, INCLUDING EGYPT

CHUDEAU, R. **L'Azaouad et le Djouf.** Ills. *La Géogr.*, Vol. 30, 1914-15, No 6, pp. 418-436. Paris. [Important new surveys, embodied on a map in 1:2,000,000, made in 1913-14 in the western Sahara from north of Timbuktu to beyond Taodeni. Chudeau's route from the latter place south lay east of Lenz's route of 1880.]

—— **l'Egypte, commerce extérieur de, Bulletin mensuel du.** 35 pp. Direction générale des Douanes Egyptiennes, Vol. 30, 1916, No. 1. Alexandria.

—— **l'Egypte, commerce extérieur de, Bulletin mensuel du.** 35 pp. Direction générale des Douanes Egyptiennes, Vol. 30, 1916, No. 2. Alexandria.

GRENFELL, B. P., AND A. S. HUNT, edits. **The Oxyrhynchus papyri: Part II.** xii and 278 pp.; ills., index. Egypt Exploration Fund, London, 1915. $5.00. 10½ x 8. [One of a series of annual publications dealing with papyri found at Oxyrhynchus, Egypt, and containing rare items of moderate interest to geographers. Such are the scraps of census reports dating back to a time before the Christian era, the accounts of the Nile overflow and ancient irrigation of the gardens, notes on commerce, festivals, and seasons.]

MILNE, J. G. **Greek and Roman tourists in Egypt.** *Journ. of Egyptian Archæology*, Vol. 3, 1916, Part 2, pp. 76-80. [Ancient tourists.]

WEIGALL, A. E. P. B. **A history of events in Egypt from 1798 to 1914.** xiii and 312 pp.; ill., index. Charles Scribner's Sons, New York, 1915. $2.25. 9 x 6.

ASIA

GENERAL

FRYER, JOHN. **A new account of East India and Persia, being nine years' travels, 1672-1681.** Edited, with notes and an introduction, by William Crooke. **Vol. III.** *Works issued by the Hakluyt Society*, Second Series, No. 39. viii and 271 pp.; ills., index. London, 1915. 21s. 9 x 6.

With the appearance of this volume the first reprint in English of John Fryer's narrative of travel comes to a close. The two previous volumes appeared as Nos. 19 and 20 in the Hakluyt series (see *Bull. Amer. Geogr. Soc.*, Vol. 42, 1910, p. 158, and Vol. 45, 1913, p. 208). The work must yield in interest, among contemporary accounts of the East, to the writings of Bernier, Tavernier, and Manucci. But it will always remain a most valuable supplement to these works.

Persia, at the end of the seventeenth century, when it was visited by Fryer, had shown hospitality to the agents of the East India Company under whose protection he traveled. He was therefore able to observe the country from vantage points denied to others. Nevertheless, a lack of sympathy with the natives appears from his lines. He is unable to suppress his westerner's contempt at the display of manners and customs unintelligible to him. This defect may be attributed to his ignorance of native languages. In other respects there is no lack of cordiality in his writings. The dry humor which pervades his book is maintained without the author's relinquishing a somewhat dignified stand.

Fryer's city breeding comes to light in his Indian notes in the form of exaggerations of the arduousness of travel over mountain passes. The "troublesome clambering" of hills from the summit of which delightfully pastoral scenes could be enjoyed with "cows grazing," "goats feeding," "cottages placed near rivulets," strike one as the Londoner's wail lamenting the loss of his comfort.

A commendable feature is the insertion of corrections and new information on subjects considered in the notes of the first two volumes. This fresh material has been embodied in the section entitled "Additional Notes."

—— **Japon, Le, et la Russie: Leurs rapports économiques.** *La Nature,* No. 2211, 1916, Feb. 12, pp. 106-108.

OKADA, T. **Some researches in the Far Eastern seasonal correlations (First note).** Diagr. *Monthly Weather Rev.,* Vol. 44, 1916, No. 1, pp. 17-21. [Reprinted from *Journ. Meteorol. Soc. of Japan,* December, 1915, Vol. 34, No. 12.]

PURNELL, C. J. **The log book of William Adams, 1614-1619, and related documents.** Diagrs., index. *Trans. and Proc. Japan Soc.,* Vol. 13, 1914-15, Part 2, pp. 156-302. London. [Deals with the voyages from Japan to the Riu Kiu Islands, Siam, and Cochin China of an English pilot who lived twenty years in Japan and died there.]

WORLD AS A WHOLE AND LARGER PARTS

IJZERMAN, J. W. **Dirck Gerritsz Pomp, alias Dirck Gerritsz China, de eerste Nederlander die China en Japan bezocht (1544-1604): Zijn reis naar en verblijf in Zuid-Amerika, grootendeels naar Spaansche bescheiden bewerkt.** xv and 195 pp.; maps, index, bibliogr. *Werken uitgegeven door de Linschoten-Vereeniging, IX.* The Hague, 1915. 10 x 7.

This volume consists of two parts, the first containing the narrative, and the second an appendix of Spanish documents forming the sources from which much of the narrative is drawn. The body of the work consists of five chapters, of which the following is a summary:

In the introductory chapter the following questions are discussed and answered by the author: (1) Was Dirck Gerritsz the first Hollander to reach Japan? Answered in the affirmative. (2) Did he open for his compatriots a way to a profitable trade with that country? He did. (3) Did he gather important information concerning the west coast of South America which was later embodied in instructions given to Admiral Jacques l'Hermite when he was about to sail in 1623 with the Nassau fleet? He did. (4) Was Gerritsz Land, or rather the Dirck Gerritsz archipelago, 64° S., discovered by him? To this question the answer is negative.

The reason for this new discussion of Dirck Gerritsz is stated to be the new Spanish sources throwing light upon his character and adventures.

The second chapter discusses the early life of Gerritsz and his sojourn in India. He was born at Enkhuizen in 1544 or 1545. At the age of eleven he was sent to Lisbon to live with his two aunts who had married Dutch merchants there. He attended school for five years and became master of the Spanish language. In 1568 he sailed from Lisbon for the purpose of seeking his fortune in India. Landing at Goa he entered the service of the King of Portugal on the India fleets. In 1582 or 1583, after a profitable trading voyage to China and Japan, he married Johanna Willemsdr (i. e. daughter) of Brussels. About this time he became acquainted with Jan Huygen van Linschoten, and they soon became intimate and lasting friends. In 1584 he wrote to his parents the letter, published herewith, concerning his voyage to India and the character of the country and its inhabitants. Soon thereafter he made a second voyage to China and Japan. He touched first at Cochin, then at Malacca, next at Macao, where he remained a considerable time. On this peninsula the Portuguese had established a trading colony in 1557 and, despite numerous difficulties with the Chinese authorities, carried on a profitable commerce with Canton on the mainland. Leaving Macao on the 5th of July, 1585, fifteen months out

from Goa, he reached Nagasaki, Japan, in twenty-six days. Gerritsz remained in Japan eight months and did a profitable business; on the 20th of March, 1586, he began his return voyage to Goa, where he arrived in April, 1588.

The expedition had been a success, but Gerritsz had lost his wife during his absence and being further unsettled by a scandal involving a godchild of his, he determined to return to his native land. There he arrived after an absence of thirty-five years with 3,000 ducats in his pocket, and with much to tell that was new and strange.

His journey to South America and return is related in Chapters III to V. Several years passed before Gerritsz again ventured on a long voyage, though this period was marked by a number of notable expeditions that might well have tempted his adventuresome spirit, among these the first voyage to India by rounding the Cape of Good Hope. The success of this venture, even at the loss of one ship and many men, led to many more. In 1598 two fleets sailed for the same destination. While these fleets were fitting out, two other expeditions were organized, one of these commanded by Admiral Oliver van Noort, with the avowed purpose of sailing in a new direction through the Straits of Magellan. The other expedition, it was given out, was to sail around the Cape to India.

The latter expedition claims our chief interest because Dirck Gerritsz (now surnamed China) had been induced to invest money in it and join it in person. He claims to have been ignorant of its real purpose and destination, which was to sail through the Straits of Magellan to Chile and Peru and exchange the cargo for silver; or, failing there, to sail to Japan. Five ships sailed on this venture, steering as if for the Cape until well down the African coast in order to deceive the crews as long as possible. Gerritsz, a passenger on the *De Hope*, the admiral's ship, had at first no definite position, but made himself indispensable as soon as they reached southern waters by his knowledge of Spanish and Portuguese. They stopped en route at Santiago, one of the Cape Verde Islands, and made a hostile landing at Annabom, nearly destroying the Portuguese settlement there. Thence they resumed their voyages January 3, 1599, to the coast of Chile.

A full account of what the five ships encountered as also a report made by Gerritsz himself to Oliver van Noort present a picture of dire distress from hunger and disease during the voyage. Gerritsz, who had been made captain of the *Vliegend Hart* on the death of its former commander, ran his ship, which fierce storms had separated from the rest of the fleet, into the harbor of Valparaiso, where, November 18, 1599, he surrendered ship and lading to the Spaniards.

Chapter IV gives an account of the trial of Gerritsz and five of his companions before the Spanish authorities. It was stated at the trial that the original goal of the expedition was India; that off the coast of Africa it was decided, but without Gerritsz' consent, to sail for Chile; that they had no instruction as to what country they should settle or trade in; that no fleet was being fitted out to follow and assist them. Being asked why he did not await the other ships at Valdivia, as agreed, Gerritsz declared that he had landed at Valparaiso for the purpose of giving himself up in order to serve his majesty the King of Spain.

The above information, never before published, throws new light on the character of Gerritsz. It would seem that he had determined to win his freedom at whatever cost. The Spaniards were at first disposed to believe him, but other information made them suspicious. The ship was confiscated as booty and the crew kept as prisoners. Of the latter's stay in Chile and Peru little is known. Of their return home we get but fragmentary and contradictory accounts. In regard to Gerritsz himself we are informed that he gained his liberty July 1st, 1604. They were all evidently regarded by the authorities as dangerous men, who had left home with hostile designs on the Spanish colonies.

BENJAMIN L. D'OOGE.

HUMAN GEOGRAPHY

ANTHROPOLOGY AND ETHNOLOGY

OSBORN, H. F. **Men of the Old Stone Age: Their environment, life, and art.** xxvi and 545 pp.; maps, diagrs., ills., index, bibliogr. Charles Scribner's Sons, New York, 1915. $5.00. 9½ x 6½.

This is one of the most notable books of the past year. The writer, who is one of the leading authorities on paleontology in the United States, brings to the subject of anthropology the viewpoint of an experienced anatomist. As president of both the New York Zoölogical Society and the American Museum of Natural History, he has had almost unique opportunities to study the mammalian forms most closely related to man. His long training in zoölogy and in somatology has enabled him to give proper weight and credit to the various physical characters of man, and his exact knowledge of the

evolutionary relationship of extinct forms has been of great service in clearly establishing the correlation in time between the various geological horizons in which human remains and artifacts have been found associated with the bones of Pleistocene mammals. This correlation, as laid down by Professor Osborn, constitutes perhaps the most valuable contribution to science contained in the book, but to most readers the wealth of illustrations, the maps, and the lucid descriptions of the successive culture periods, will be matters of great surprise and interest. The science of prehistoric anthropology, dealing as it does with the evolution of man from his ancestors in the Pliocene down to and including the closing phases of the Paleolithic, is of such recent development that each successive book of first-class authority practically incorporates, expands, and brings down to date, the work of its predecessor. With Professor Osborn's work before the general reader practically all older works dealing on the subject may be discarded, except so far as earlier writers have special knowledge of some one particular phase of human archaeology. A number of books have been published abroad in which a modicum of intimate knowledge of some one station or cave has been used as the excuse for a review of the entire field of anthropology, and to such books "Men of the Old Stone Age" is in refreshing contrast.

It is very fortunate, in these days of growing interest in eugenics and in the study of the races of man, that a scientist of Professor Osborn's standing and authority has clearly brought out the unmistakable evidence of the continuity of inheritance throughout vast periods of time.

The race of the Cro Magnons who occupied the stage during the entire Upper Paleolithic, including the Aurignacian, Solutrean, Magdalenian, Azilian subdivisions, appear to have been intellectually and physically the absolute superiors of even the higher European races of today, and in this respect they resembled, in intellect at least, the Greeks.

The bearing of such an astounding discovery on the questions of the present time, especially those relating to the migration of races, which we now call immigration, is clear, and the importance of maintaining the breed and stock of the finer races in unimpaired purity, must in consequence be sooner or later recognized. Theodore Roosevelt recently stated that the publication of this book by Professor Osborn constituted to his mind the one intellectual oasis in the desert of futility and verbiage, both political and intellectual, which has been so characteristic of American life during the last four years.

MADISON GRANT.

GODDARD, P. E. **Language as an index to ancient kinships.** *Amer. Museum Journ.*, Vol. 16, 1916, No. 3, pp. 197-198.

MYRES, J. L. **The influence of anthropology on the course of political science.** *Univ. of California Publ. in Hist.*, Vol. 4, 1916, No. 1, pp. 1-81.

ECONOMIC GEOGRAPHY

Production

CARVER, T. N. **Selected readings in rural economics.** viii and 974 pp.; index. Ginn & Co., Boston [1916]. $2.80. 8½ x 6.

This is primarily a "source book" for students of agricultural economics. But it is something more than this, for it brings together in available form much material of interest to the general reader, to the student of economics and industrial history, to the interested farmer and the "back-to-the-land" man, who above all others needs practical, authoritative information of a protective nature.

The selections reprinted here are grouped under eight heads: general principles; agricultural history; land tenure; agricultural labor; the farmer's business; agrarian movements in the United States; rural organization and marketing; agricultural policy.

Of these the general reader and the farmer would find most interesting and helpful the first, fifth, and seventh of these sections and, in the second, the passages devoted to American agricultural history. Other individual chapters are equally helpful.

The student of economic conditions and of pressing political questions, such as co-operative marketing and agricultural credit, will find the book stimulating and helpful. It should be remembered, however, that it is a supplementary source volume of greatest value when read in association with some authoritative text on rural economics.

RICHARD ELWOOD DODGE.